Categorical Use Attainability Analysis for Recreation

Designation of Wyoming Waters
for
Primary and Secondary Contact Recreation

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SUMMARY

The state of Wyoming has two designations for recreational use of surface waters, primary contact recreation and secondary contact recreation. Primary contact recreation or primary waters are those where recreational activities would be expected to result in full immersion and/or ingestion of water. Secondary contact recreation or secondary waters are those where contact with water is expected to be either incidental or accidental and would not be expected to result in either full immersion or ingestion of water. During the 2007 revision of Wyoming's Surface Water Quality Standards, waters in Table A of the *Wyoming Surface Water Classification Lis*t were designated for primary contact recreation. Those waters not listed in Table A of the Surface Water Classification List were designated for secondary contact recreation. These designations were disapproved by the Environmental Protection Agency (EPA) because a use attainability analysis (UAA) had not been completed to support the changes.

The *Categorical Use Attainability Analysis for Recreation* (hereafter referred to as the recreational use model) described in this document was developed to fulfill EPA's requirement that a UAA be completed prior to designating waters for secondary contact recreation. WDEQ/WQD developed this predictive model using Geographic Information Systems (GIS) to determine which waters of the state are more appropriately designated for primary or secondary contact recreation. The model was developed using a select set of data layers, which were analyzed together and used to predict recreational use of waters (streams and waterbodies) of the state. Some layers were used to default primary contact recreation designations for waters of the state and other layers were used to assign weights to streams segments and waterbodies (lakes, ponds, reservoirs, etc.). Cumulatively, the weights resulted in a recreational use number (RecNum) for each stream segment or waterbody. The RecNum that most appropriately identified waters as primary or secondary contact recreation was determined by calibrating the model with 151 field surveys conducted by the Wyoming Department of Environmental Quality. Stream segments and waterbodies with RecNum above this threshold were designated for primary contact recreation and waters below the value were designated for secondary contact recreation. The model was then validated using 720 field surveys conducted by the Wyoming's 34 Conservation Districts. There was 73% agreement between the Conservation District surveys and the predictions of the GIS model. Stream segments designated for primary contact recreation were extended to minimize the occurrence of short, isolated reaches. The model resulted in 12% or 33,832 miles of streams and 91% or 538,863 acres of waterbodies being designated for primary contact recreation.

BACKGROUND

History of Recreational Designated Uses in Wyoming

As outlined in Wyoming's Surface Water Quality Standards (Water Quality Rules and Regulations, Chapter 1), the state has two designated uses for recreation, primary and secondary contact recreation, and a summer recreation season (May 1 through September 30).

Primary contact recreation is defined as "any recreational or other surface water that could be expected to result in ingestion of the water or immersion (full body contact)". Secondary contact recreation is defined as "any recreational or other surface water use in which contact with the water is either incidental or accidental and that would not be expected to result in ingestion of the water or immersion." The water quality criteria protective of these two recreational uses varies. *Escherichia coli* (*E. coli*) concentrations in primary contact recreation waters cannot exceed a 30-day five sample geometric mean of 126 colonies/100 mL during the summer recreation season and 630 colonies/100 mL during the non-recreation season. Waters designated for secondary contact recreation cannot exceed a 30-day five sample geometric mean of 630 colonies/100 mL during any period (WDEQ/WQD 2007a).

Although recreational use designations and the criteria associated with those designations have changed through various revisions of Wyoming's surface water quality standards, the concept of varying criteria based on recreational use designation dates back to the 1968 surface water quality standards. These standards applied only to interstate waters, with most interstate waters designated for limited body contact use (five sample geometric mean not to exceed 2,000 fecal coliform colonies/100 mL) and a handful of large rivers and reservoirs assigned more stringent fecal coliform criteria (five sample geometric mean not to exceed 240 colonies/ 100 mL or 750 colonies/100 mL in any one sample; WDPH 1968).

The 1973 version of Wyoming's water quality standards was drafted so that the state would be in compliance with 'The Federal Water Pollution Control Act Amendments of 1972', later known as the Clean Water Act (CWA). These standards designated waters for both full and secondary body contact recreation and also defined a recreation season. Waters of the state were divided into three classes, 1, 2, and 3, and only a small number of Class 1 waters were designated for full body contact recreation. The criteria for these waters was a five sample geometric mean not to exceed 200 fecal coliform colonies/100 mL or more than 10% of samples to exceed 400 colonies/100 mL during the May 1 through September 30 recreation season. Class 2 waters and some Class 1 waters were designated for secondary body contact recreation, with a criterion of a five sample geometric mean not to exceed 1,000 fecal coliform colonies/100 mL or more than 10% of samples to exceed 2,000 colonies/100 mL during the May 1 through September 30 recreation season. No recreational use designation or criteria applied to Class 3 waters (WDHSS 1973).

Comparing Wyoming's 1973 recreational use designations and criteria to EPA's more recent guidance regarding recreational uses reveals a shift in EPA's interpretation of CWA Section 101(a)(2) goal of "recreation in and on the water". Whereas historically, multiple recreational uses designations and waters with no recreational use designations were acceptable, more recently, EPA has asserted that the CWA establishes a rebuttable presumption that primary contact recreation is attainable and should apply to all waters (EPA 2008). It is this more recent interpretation of the CWA and the state's desire to appropriately designate waters based on their recreational use that has resulted in the development of this categorical UAA.

Between 1973 and 2001, Wyoming had two recreational use classes, full body contact recreation and secondary body contact recreation. Standards prior to 1990 listed waters designated for full body contact recreation, with all other waters in the state designated for secondary body contact recreation. Standards after 1990 listed waters designated for secondary body contact recreation, with all other waters in the state designated for full body contact recreation. In the 2001 version of the surface water quality standards, waterbody designations were moved to a separate document, *Wyoming Surface Water Classification List,* and all waters were held to the same recreational standard (WDEQ/WQD 2001). Criteria included a 30-day five sample geometric mean not to exceed 200 fecal coliform colonies/100 mL or a 24-hour three sample geometric mean not to exceed 400 fecal coliform colonies/100 mL. The definition of secondary contact recreation remained part of the standards despite no specific waters being designated for secondary contact recreation (WDEQ/WQD 2001b).

During the 2007 revision of Chapter 1, Section 27, *E. coli* Bacteria, was modified to comply with federal recommendations regarding recreational use protection criteria, including a change in the indicator organism for bacterial contamination from fecal coliform to *E. coli*. The 2007 revision also designated "all waters in Table A of the Wyoming Surface Water Classification List….for primary contact recreation unless identified as a secondary contact water by a "(s)" notation. Waters not specifically listed in Table A of the Wyoming Surface Water Classification List shall be designated as secondary contact waters" (WDEQ/WQD 2007a).

Although Wyoming had changed the recreational use designation of waters during previous revisions of the water quality standards, EPA disapproved the designation of a large number of waters for secondary contact recreation without conducting a UAA. EPA outlined that in order to resolve the disapproval, "the State will need to delete the language in Section 27(a)" and "for waters where the State believes that further review of the appropriate recreation use is warranted, the best option would be to utilize the Wyoming DEQ's Recreational Use Designations Use Attainability Analysis (UAA) Worksheet on a site-specific basis"…. or "another option……would be to work with the Region to develop a categorical UAA" (EPA 2008).

After receiving a large number of site-specific recreation UAAs and recognizing the overwhelming public interest in the issue, WDEQ/WQD determined that a statewide categorical UAA would be the most effective and efficient method for designating recreational use for waters in the state. WDEQ/WQD recognizes that a statewide UAA will not designate the recreational use of all waters of the state correctly and that uses can change over time. As such, waterbody specific UAAs will continue to be used as a tool to designate waters for primary or secondary contact recreation when more information is available.

INTRODUCTION

Origin and Applicability of Wyoming's Recreational Use Criteria

Wyoming's criteria to protect waters for recreational use are based on EPA's recommended bacteria criteria, which were last revised in *Quality Criteria for Water 1986.* The rationale for

the 1986 criteria outlines that the "recreational water quality criterion can be defined as a 'quantifiable relationship between the density of an indicator in the water and the potential human health risks involved in the water's recreational use.' From such a definition, a criterion can be adopted which establishes upper limits for densities of indicator bacteria in waters that are associated with acceptable health risks for swimmers."

The criteria were derived from a "series of studies at marine and fresh water bathing beaches …. to determine if swimming in sewage-contaminated marine and fresh water carries a health risk for bathers", with the final freshwater criteria causing "an estimated 8 illnesses per 1,000 swimmers." The rationale describes that "the situation needing the most rigorous monitoring is the designated swimming beach. Such areas are frequently lifeguard protected, provide parking and other public access and are heavily used by the public". Other "recreational resources may be natural wading ponds used by children or waters where incidental full body contact occurs because of water skiing or other similar activities" (EPA 1986).

As a predominately rural state with large semi-arid to arid basin and plains ecoregions, Wyoming has large areas where few, if any, waters meet the description of recreational use outlined in EPA's 1986 criteria. As of 2010, Wyoming had 5.8 persons per square mile, compared to national average of 87.4 persons per square mile (USCB 2012). Moreover, between 1971 and 2000, the mean annual precipitation for more than 75% of the state was less than 20 inches per year (NRCS 2006). Despite these characteristics, the majority of the state's waters are currently designated for primary contact recreation, without consideration of existing or potential recreational use. This conservative approach to designating recreational uses is problematic when assessing waterbody impairments, developing Total Maximum Daily Loads (TMDLs), and establishing permit limits for point discharges. As of 2010, over 50% of Wyoming's 303(d) Listed waters were impaired for not meeting their designated recreational use (WDEQ/WQD 2010). This includes over 60 waters, some of which are not likely used for primary contact recreation and pose no significant health threat. Because 303(d) Listings ultimately result in development of Total Maximum Daily Loads (TMDLs), inaccurate designation of uses can result in significant costs. In addition to the cost of developing a TMDL, resource monitoring, water treatment costs, and BMP implementation can be resource intensive. As a result, ensuring that recreational use designations are applied accurately is important to direct limited resources to those waters where threats to public health truly exist.

A 2006 study by Meyerhoff et al. reviewed how each state designates recreational uses and how criteria to protect those uses are applied. The study found that issues similar to those in Wyoming occur in other states, and highlighted that the TMDL process has increased interest in ensuring that recreational use designations are applied correctly. The review cites a survey of state regulators that found that "nearly half of all 303(d) Listings may not have been necessary if there had been a quick and cost-effective way to revise water quality standards to more accurately reflect the true use potential of waterbodies". The review also identifies that no two states have implemented bacterial standards using the same approach and that the EPA has approved a multitude of approaches, including some that are substantially different from the recommendations contained in federal guidance. Many states have waters designated for

primary and secondary contact recreation, similar to Wyoming's approach, while other states have additional recreational use designations, including waters with no protection for recreation (Meyerhoff et al. 2006).

Region 8 Recreational Use Designations and Criteria

A review of recreational use designations and criteria for states in EPA Region 8 (i.e. Montana, South Dakota, North Dakota, Utah, Colorado, and Wyoming) found similar results to the national survey. Each state in EPA Region 8 has slightly different approaches to recreational use designations and criteria, although most are consistent with Wyoming's two recreational use categories and recreational use season. With the exception of Utah, all states in Region 8 have recreational use seasons or waters where designations differ based on the time of year. All states in Region 8 have multiple recreational use categories and many states (i.e. Montana, South Dakota, Colorado, and Utah) have large groups or types of waters not designated for primary contact recreation.

Montana has three recreational use categories with varying criteria. Class D, E, F, and G waters are designated for secondary contact recreation and include constructed ditches, seasonal and semi-permanent lakes, ephemeral streams, and ponds constructed for the disposal of coal bed methane water (MDEQ 2006). South Dakota has immersion recreation waters and limited contact recreation waters. Most South Dakota streams are designated for limited contact recreation, while most lakes are designated for immersion contact recreation (ARSD 2009). Colorado has four recreational use classes, including not primary contact use (Class N) waters. Class N waters are "not suitable or intended to become suitable for primary contact recreation uses" and "shall be applied only where a use attainability analysis demonstrates that there is not a reasonable likelihood that primary contact uses will occur in the water segment(s) in question within the next 20-year period." As of 2011, Colorado had over 100 Class N waters, including some with seasonal designations (CDPHE 2011). Utah has three recreational use designations, 1C, 2A, and 2B. Class 2B waters are protected for infrequent primary contact recreation and include most of Utah's waters (UDEQ/DWQ 2010).

All of the recreational use designations described above have numeric criteria corresponding to the level of use. The most commonly used criteria is five times the geometric mean value used to protect primary contact recreation, as identified in EPA's *Implementation Guidance for Ambient Water Quality Criteria for Bacteria* (EPA 2004). Similar to Wyoming, the geometric mean of *E. coli* bacteria in secondary contact waters in Montana, limited contact recreation waters in South Dakota, and not primary contact recreation waters in Colorado, are not to exceed 630 colonies/100 mL.

Wyoming's two categories of recreational use, criteria to protect those uses, and recreational use season are consistent with other states in EPA Region 8. Further, many states in the region (e.g. Montana, Colorado, South Dakota, and Utah) have categories or significant numbers of waters that are protected for recreation at levels less than primary contact recreation. Wyoming's intention of designating waters for recreational use based on existing and potential

use is consistent with other approved water quality standards within the region. Appropriately designating waters of the state based on their actual recreational use will ensure that public health is protected, yet prevent overly protective criteria in areas where primary contact recreation does not occur.

USE ATTAINABILITY ANALYSIS PROCESS

Process to Change Designated Uses in Wyoming

Chapter 1, Section 4 describes the classes and designated uses for surface waters in Wyoming and Section 33 outlines the process to reclassify waters and develop site specific criteria. Section 33 specifies that "the Water Quality Administrator may lower a classification, remove a designated use that is not an existing use or an attainable use, establish ambient-based criteria on effluent dependent waters, or make a recommendation to the Environmental Quality Council to establish sub-categories of a use, or establish site-specific criteria if it can be demonstrated through a use attainability analysis (UAA) that the original classification and/or designated use or water quality criteria are not feasible because:

(i) Naturally occurring pollutant concentrations prevent the attainment of the classification or use; or

(ii) Natural, ephemeral, intermittent or low flow conditions or water levels prevent the attainment of the use, unless these conditions may be compensated for by the discharge of sufficient volume of effluent discharges without violating state water conservation requirements to enable uses to be met; or

(iii) Human caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place; or

(iv) Dams, diversions, or other types of hydrologic modifications preclude the attainment of the classification or use, and it is not feasible to restore the water body to its original condition or to operate such modification in such a way that would result in the attainment of the classification or use; or

(v) Physical conditions related to the natural features of the water body such as the lack of a proper substrate, cover, depth, pools, riffles, and the like, unrelated to water quality, preclude attainment of the classification or use; or

(vi) Controls more stringent than those required in Section 301(b) and 306 of the Federal Act would result in substantial and widespread economic and social impact. This subsection shall not apply to the derivation of site-specific criteria" (WDEQ/WQD 2007a). The six removal factors outlined above are derived from the Code of Federal Regulations (CFR) §131.10(g), which outline that "states may remove a designated use which is *not* an existing

use, as defined in CFR §131.3, or establish sub-categories of a use if the State can demonstrate that attaining the use is not feasible…". As outlined in both state and federal regulations, a UAA must utilize these six factors to demonstrate that a use is not attainable and therefore can be removed. Chapter 1 and federal regulations define UAAs similarly; Chapter 1 Section 2(b)(liv) defines a UAA as "a structured scientific assessment of the factors affecting the attainment of the use. The factors include physical, chemical, biological, and economic factors as described in Section 33 of these regulations" (WDEQ/WQD 2007a).

Additional guidance for UAAs in Wyoming is provided in the *Use Attainability Analysis Implementation Policy*. Section VII of the policy outlines the UAA process for Recreation Designations and includes a Recreational Use Designations Use Attainability Analysis (UAA) Worksheet. The worksheet describes the use removal factors outlined in Chapter 1, Section 33 and states that "most commonly, the factors that apply to reclassifying a water from primary to secondary contact designation are 33(b)(ii) or (v) though there may be unique circumstances where one of the other factors is most appropriate" (WDEQ/WQD 2007b). The policy also outlines that "the decision as to whether a water is most appropriately designated for primary or secondary recreation protection is not intended to be a difficult one. It is based solely on the relative potential of exposure to human populations. There are only a few factors relating to water availability, access, and recreational opportunity that need to be considered" (WDEQ/WQD 2007b). The recreational use model focuses on these factors (i.e. relative potential of exposure to human populations, water availability, access, and recreational opportunity) to determine the most appropriate recreational use designation for waters of the state.

EPA Guidance on Recreation Use Attainability Analyses

Since the publication of the 1986 recreation criteria, EPA has released a number of national and regional guidance documents to facilitate implementation of the bacteria criteria. These guidance documents outline that protection for primary contact recreation is not necessary on every water and effectively articulate the difficulty of applying the six removal factors to recreation UAAs.

A 1992 Region 8 Guidance, *Recreation Standards and the CWA Section 101(a)(2) "Swimmable Goal"* outlines that "although assigning swimmable goal standards to all waters would clearly satisfy all requirements pertaining to recreation and fully protect public health, Region VIII recognizes that there may be some waterbodies where application of such standards may be unnecessary. For example, in situations where an evaluation of the relevant factors indicates that existing and potential primary contact recreation uses cannot reasonably be presumed to exist, it may not be necessary or appropriate to set standards in support of the swimmable goal" (EPA 1992).

Similarly, the 2004 EPA *Implementation Guidance for Ambient Water Quality Criteria for Bacteria* outlines that "where a state or authorized tribe has determined that primary contact recreation is not an existing use as defined by federal and state (or tribal) regulations, nor

attainable for one of the reasons identified in the federal and state (or tribal) regulations, states and authorized tribes may adopt other categories of recreation such as intermittent primary contact recreation, wildlife impact recreation, or secondary contact recreation." The guidance also states that "a seasonal recreational use may be appropriate for those states and authorized tribes where ambient air and water temperatures cool substantially during the winter months" (EPA 2004). Wyoming's summer recreation season and secondary contact recreation class are consistent with EPA guidance. As such, placement of waters into the secondary contact recreation use category through this categorical UAA is consistent with EPA guidance.

The 1992 Region 8 guidance outlines four options to achieve compliance with the requirements associated with the swimmable goal, one of which is to "conduct and submit to EPA for review use attainability analyses (UAAs) for all waters where recreation standards are not consistent with the CWA Section 101(a)(2) goal" (EPA 1992). Similarly, Section 3.5.1 of EPA's 2004 *Implementation Guidance for Ambient Water Quality Criteria for Bacteria* identifies that "states and authorized tribes may assign less than 'swimmable' standards where adoption of such a standard is adequately justified by a use attainability analysis (UAA)". The 2004 guidance also states that "less than 'swimmable' standards may be considered, for example, where flowing or pooled water is not present within a waterbody during the months when primary contact recreation would otherwise take place and the waterbody is not in close proximity to residential areas, thereby indicating that primary contact uses are not likely to occur. Also, if a state or authorized tribe can demonstrate that natural, ephemeral, intermittent, or low flow condition or water levels prevent attainment of the primary contact recreation use, a secondary contact recreation use may be appropriate" (EPA 2004).

As part of the discussion on use of the six removal factors outlined at 40 CFR 131.10(g), the 1992 guidance says, "some have questioned whether existing EPA regulations and policies provide States with sufficient opportunity to ever conclude that swimmable goal standards are not attainable. For example, if physical factors are not to be considered, this seems to eliminate factors 2, 4, and 5 above. Further, factor 1 does not seem relevant because bacteriological criteria drive most recreation use decisions, and although information is lacking, human sources of fecal contamination are generally considered as the primary source of human health risk. Following this logic, Factor 3 also does not seem relevant because most, if not all, human sources of fecal contamination can be remedied if funds are available. This leaves only the economics factor (number 6), which is probably not broadly applicable because of the range of affordable disinfection options currently available. Situations involving failing septic systems or unmanned package plants are possible exceptions to this general conclusion" (EPA 1992). Likewise, the 2004 guidance states that "physical factors alone are not sufficient justification for removing or failing to designate a primary contact recreation use. Likewise, the general Agency policy is to place emphasis on the potential uses of a waterbody and to do as much possible to protect the health of the public" (EPA 2004).

Section 3.5.2 of the 2004 guidance states that "EPA's suggested approach to the physical factors issue is for states and authorized tribes to look at a suite of factors such as whether the waterbody is actually being used (or has been used) for primary contact recreation; existing water quality; water quality potential; access; recreational facilities; location (i.e. proximity to recreational facilities); safety considerations, and; physical attributes of the waterbody in making any use attainability decision" (EPA 2004). Similarly, the Region 8 guidance identifies the "factors that should be considered in conducting a UAA include the following: existing recreation uses of the waterbody, water quality, access, facilities, location, physical conditions, and costs associated with achieving compliance with swimmable goal standards" (EPA 1992). Consistent with EPA guidance on recreational UAAs, the recreational use model focuses on a suite of factors to determine the most appropriate recreational use designation for waters of the state.

Previous Recreation Use Attainability Analyses in Wyoming

On June 27, 2011, the WDEQ/WQD administrator approved the reclassification of eleven waterbodies in the North Platte Basin for secondary contact recreation. The reclassifications were based on UAA's submitted by the Goshen County Conservation Districts and followed the procedures outlined in Chapter 1 and the *Use Attainability Analysis Implementation Policy*. EPA approved the recreational use reclassifications in a December 28, 2011 action letter. The approval letter described "that secondary contact recreation appropriately defines the existing and expected future recreational use of these waterbodies. This expectation is due to the lack of known existing primary contact recreational use, in addition to the remoteness and inaccessibility that would prevent future use of the waterbodies for primary contact recreation."

The letter also described that "EPA relied on the following key information when making our determination to approve the recreation use revisions.

- Multiple photographs documenting limited flow, small channel, remoteness, and water resources that are typically not suitable for primary contact recreation.
- The lack of known existing primary contact recreation activities such as swimming, bathing, and child's play.
- The lack of physical characteristics that would invite primary contact recreational use (e.g. beaches and boat docks).
- Isolation from parks, recreation areas, municipalities, high density housing areas, schools, or other areas frequented by children.
- Land surrounding the waterbodies is predominantly private, with just a few instances of water flowing near or through state trust land."

The letter also stated that "overall, EPA concurs with Wyoming's decision that secondary contact recreation more appropriately defines the recreational use for the 11 waterbodies due to the natural physical features of the waterbodies (limited water and flow; 40 CFR §131.10(g)(2)) and lack of known exiting primary contact recreational use. Additionally, the

remoteness and inaccessibility would be expected to prevent future use of the waterbodies for primary contact recreation" (EPA 2011). The recreational use model uses many of the same characteristics and information identified by EPA to approve the designation of waters in the North Platte Basin for secondary contact recreation.

Categorical Use Attainability Analysis

As mentioned previously, one of EPA's suggestions in their September 29, 2008 letter acting on Wyoming's 2007 revision of Chapter 1 was "to work with the Region to develop a categorical UAA." The action letter goes on to state that "the Region cautions that the defensibility of a categorical approach would likely depend on identifying a category or categories of waters that are sufficiently similar such that it is reasonable to use site-specific information for a representative sample of locations to characterize the existing and potential uses for the entire category (e.g. ephemeral waters)" (EPA 2008).

WDEQ/WQD used geographic information systems (GIS) to represent the existing and potential use of waters for primary contact recreation. The geographic, hydrologic, and demographic characteristics of Wyoming are conducive to using GIS to determine recreational use. GIS data layers represent the hydrologic characteristics of waters of the state as well as characteristics that may attract people to specific waters for recreation. GIS also allowed WDEQ/WQD to assign the same criteria to all waters across the state, effectively fulfilling the "site-specific evaluation" requirement described in the Use Attainability Analysis Implementation Policy and "site-specific information" condition outlined in EPA's September 2008 action letter. Details of the components, process, and results of the model are provided below.

METHODS and RESULTS

Data Layers, Buffers, and Weightings

Data layers used in the model were derived from multiple sources (Table A-1; Appendix A). Data were downloaded and used directly from a given source, obtained from multiple data sources and combined into one dataset, or generated by WDEQ. Datasets used in the model may not be identical to the datasets listed in Table A-1 and outlined below, as some entities periodically update their data.

Layers, sub-categories of layers, and buffers of various distances were used to assign default primary designations or weights to each stream segment and waterbody (Table 1). Default primary designations were assigned to: the largest stream in a six digit hydrologic unit code (HUC6); wild and scenic rivers; all waterbodies greater than 4 acres in size; waters within municipalities and high density housing areas; waters within national parks, state parks, historic sites, and wildlife habitat management areas; waters within 1.5 miles of a school; and waters within 0.5 miles of an established campground, United States Forest Service (USFS) recreation site, natural area, and Wyoming Department of Transportation (WYDOT) rest area. Where

Table 1. Datasets, buffers, and weightings used in the recreational use model.

Category	Dataset	Categories or Buffer Distance (miles)	Designation or Weighting
Streams	NHD Stream Size	Largest Stream in HUC6	Primary
	Wild and Scenic Rivers		Primary
	NHD Hydrologic Classification	Perennial	7
		Intermittent	3
Lakes	NHD Waterbody Size	Greater than 4 acres	Primary
	NHD Waterbody Hydrologic Classification	Perennial	7
		Intermittent	3
Populated Places and Schools	Municipalities, Census Blocks with Populations Greater than 40 persons/square mile	Within Boundary	Primary
		2	5
		3	3
	Schools	1.5	Primary
		3.5	5
		4.5	3
Established Recreation Areas	Campgrounds	0.5	Primary
		2.5	5
		3.5	3
	USFS Recreation Sites, Natural Areas, and WY DOT Rest Areas	0.5	Primary
		2.5	5
		3.5	3
	National Parks (NP), State Parks (SP) and Historic Sites (HS), Wildlife Habitat Management	Within Boundary	Primary
		2	5
		3	3
Other Recreation Areas	Trailheads	0.5	5
		2.5	3
		3.5	1
	Dispersed Campsites	0.5	5
		2.5	3
		3.5	1
Fishing	WGFD Database	Game Fish	7
Access	Roads	0.25	5
	Trails	0.25	5
	Land Management	Public	5

stream segments or waterbodies were assigned weights, higher weights were assigned to features more likely to attract primary contact recreation or to buffer distances closer to areas that might attract primary contact recreation. Where buffers were used, distances were based both on known travel distances from a site (e.g. schools) and on a general understanding of distances people travel from a given type of recreation area. For waters not defaulted into primary contact recreation categories, the weights were added and depending on the final score for each stream segment or waterbody, classified for primary or secondary contact recreation. See Appendix B for a step by step process of how the model was developed.

Streams and Lakes

The National Hydrography Dataset (NHD) was used as the foundation of the recreational use model. The high resolution, 1:24,000, NHD is the most current and detailed representation of streams and waterbodies (lakes, reservoirs, and ponds) in Wyoming. Streams and waterbodies are two separate layers within the NHD; the stream layer was comprised of 799,002 stream segments, equivalent to 280,799 stream miles, and the waterbodies layer was comprised of 99,816 waterbodies totaling 591,195 acres. The NHD was used to assign weights to stream segments (Figure A-1) and waterbodies (Figure A-2) based on their hydrologic classification (i.e. perennial, intermittent, and ephemeral). Perennial and intermittent classifications were assigned weights of 7 and 3, respectively, while ephemeral waters received no weight (Table 1).

The NHD was used to assign default primary designations to stream segments based on size. Stream segments comprising the largest stream within each HUC6, approximately 2,337 stream miles, were defaulted for primary contact recreation (Table 1; Figure A-3). These included the Snake, Yellowstone, Bear, Green, Wind/Bighorn, Little Snake, Tongue, Powder, Belle Fourche, Cheyenne, Niobrara, and North Platte Rivers.

Waterbdodies larger than four acres in size also received a default primary designation (Table 1; Figure A-4). The four acre size class was selected based on the size guidelines used by the Wyoming State Engineers Office to permit stock pond reservoirs. Stock pond reservoirs up to 20 acre-feet and 15 feet deep (20 feet maximum depth with 5 feet of free board between maximum depth and spillway), or four acres, may be permitted (WSEO 2006). Waterbodies less than four acres in size were assigned weights using the other layers outlined in Table 1. Waterbodies located on a primary stream segments were defaulted as primary (Table 1).

Wild and Scenic Rivers received default primary designations (Table 1; Figure A-5). Wyoming has two wild and scenic river designations, the Snake River Headwaters and the Clarks Fork of the Yellowstone River. The Snake River Headwaters include portions of the Lewis River, Snake River, Pacific Creek, Soda Fork, North Buffalo Fork, South Buffalo Fork, Blackrock Creek, Buffalo Fork, Gros Ventre River, Crystal Creek, Shoal Creek, Granite Creek, Willow Creek, Hoback River, Bailey Creek, and Wolf Creek.

Populated Places and Schools

High density housing areas and schools were treated similarly because both are frequented by children. Stream segments and waterbodies located within the boundaries of high density housing areas and within 1.5 miles of each school were given a default primary designation. Buffers of 2.0 miles and 3.0 miles from the default primary areas were assigned weights of 5 and 3, respectively (Table 1) to further protect for the possibility of child's play.

The populated places layer (Figure A-6) was derived from two sources, the Wyoming GeoLibrary (Municipal Boundaries for Wyoming at 1:24,000) and the US Census Bureau (2000 Census TIGER/Line data). Because the municipalities dataset did not encompass all of the high density housing areas within the state, census blocks with a population density greater than 40 persons

per square mile were derived from the 2000 census data. Population densities greater than 40 persons per square mile were chosen because this density represented the lowest density areas of the municipalities dataset.

School locations were derived from a combination of U.S. Department of Education and Wyoming Department of Education references (375 schools; Figure A-7). A default primary buffer distance of 1.5 miles was selected based on the distances students are expected to walk to school; elementary schools students are bused if they live a distance of greater than 1.0 miles from a school location, while middle and high school students are bused if they live further than 1.5 miles from their school (WDE 2002).

Established Recreation Areas

Established recreation areas in the state were identified as campgrounds, USFS recreation sites, natural areas, WYDOT rest areas, national parks, state parks and historic sites, and wildlife habitat management areas. Stream segments and waterbodies within the boundaries of parks, monuments, historic sites, or wildlife habitat management areas or within 0.5 miles of other types of established recreation areas were assigned default primary designations. Stream segments or waterbodies within 2.0 and 3.0 miles of the default primary area were assigned weights of five and three, respectively (Table 1).

Campground locations were derived from the Wyoming GeoLibrary (Campgrounds from the USGS Names Database for Wyoming at 1:24,000) and USFS datasets (378 campgrounds; Figure A-8). Recreation sites were obtained from the USFS (e.g. picnic areas and boat ramps), natural areas from the Wyoming GeoLibrary (Natural Area Tourist Visitation Places for Wyoming at 1:100,000), and rest areas from the WYDOT (183 recreation sites; Figure A-9). National Park Service areas, State Parks and Historic Sites, and Wildlife Habitat Management Areas (Figure A-10) were derived from the National Parks Service data store (8 areas; 2.3 million acres), the State Parks, Historical Sites and Trails Department (49 areas; 119,000 acres) and WGFD (72 areas; 408,000 acres).

Other Recreation Areas

Other recreation areas (trailheads and dispersed campsites) were identified and assigned weights based on distance from the site. Stream segments or waterbodies within 0.5, 2.5, and 3.5 miles of a trailhead or dispersed campsite were assigned weights of 5, 3, and 1, respectively (Table 1). Trailhead locations were derived from USFS datasets (258 trailheads; Figure A-11). Other trailhead locations within the state (i.e. trailheads within national parks, state parks, historic sites, etc.) were not included in the dataset, as streams and waterbodies within the boundaries of these areas are primary by default.

Dispersed campsite data were received in point, line, and polygon formats from Bighorn, Black Hills, Bridger-Teton, Caribou-Targhee, Medicine Bow, Shoshone, and Uinta-Wasatch-Cache National Forests. In portions of Bighorn, Bridger-Teton, and Shoshone National Forests where data was lacking, WDEQ personnel collected data directly using GPS surveys (Figure A-12). Any

dispersed campsite located within a campground layer buffer received no weighting to avoid duplication.

Fishing

The presence of game fish in waters of the state was derived from the Wyoming Game and Fish Department (WGFD) Stream and Lake database provided to WDEQ in 2009 (Figure A-13). The water identification code in the database was cross-indexed with the Reach Code of the NHD, allowing stream segments and waterbodies to be connected with fish species. Stream segments and waterbodies associated with game fish were assigned a weight of 7 (7,048 locations; Table 1), the same weight applied to perennial waters.

Access

Access was represented by three datasets: roads, trails, and land management. Roads and trails were given a 0.25 mile buffer and stream segments and waterbodies within the buffer assigned a weight of 5. Stream segments and waterbodies located on public lands were also assigned a weight of 5 (Table 1).

Two sources were used to obtain a sufficient roads layer for the state, WYDOT and USFS (Figure A-14). WYDOT highways and county road datasets were combined with USFS roads suitable for passenger cars (USFS categories 3-5), resulting in an approximately 29,000 mile dataset. USFS roads suitable for passenger cars were based on a USFS roads scale of 1-5: basic custodial care (1), high clearance vehicles (2), suitable for passenger cars (3), moderate degree of user comfort (4), and high degree of user comfort (5).

The trails layer combined the continental divide trail with USFS trails, resulting in an approximately 12,000 mile dataset (Appendix A-15).

The land management layer was derived from the Bureau of Land Management (BLM) GIS data server for Wyoming (Figure A-16). Land management was divided into public and private lands; public land included all lands managed by the National Park Service, National Grasslands, Bureau of Indian Affairs, Fish and Wildlife Service, USFS, State, BLM, Department of Energy, Bureau of Reclamation, Department of Defense, and Corps of Engineers. All other lands were private.

Tribal Lands

The classification of waters for recreation only applies to waters in the State of Wyoming and does not apply to waters that are located on tribal lands. Tribal lands (i.e. Indian country) is defined in 18 U.S.C. Section 1151 and includes any land held in trust by the United States for an Indian tribe and any other areas defined as “Indian country” within the meaning of 18 U.S.C. 1151. EPA, or authorized Indian tribes, will retain responsibility for designations of waters on tribal lands.

Translating Weights to Recreation Use Categories

Each stream segment or waterbody not defaulted as primary was assigned weights based on the layers described above. Weights for the layers were summed, resulting in a recreational use number (RecNum) for each stream segment and waterbody. Stream segments and waterbodies were separated into forest and non-forest (basin) areas because forested areas generally have a higher occurrence of factors that may attract recreationists. Differentiating forest and basin areas allowed a higher RecNum to be used to designate waters for primary contact recreation in forest areas. The forest layer was derived from US Forest Service (USFS; Figure A-17) and all stream segments and waterbodies within the boundaries of National Forests were categorized as forest. Streams were clipped at the forest boundary and waterbodies that fell partially within forest boundaries were categorized as forest.

Site surveys conducted by WDEQ/WQD were used to calibrate the model and identify the RecNum of forest and basin sites that most appropriately classified waters for primary and secondary contact recreation (Figure 1; Figure C-1). WDEQ/WQD conducted a total of 151 site

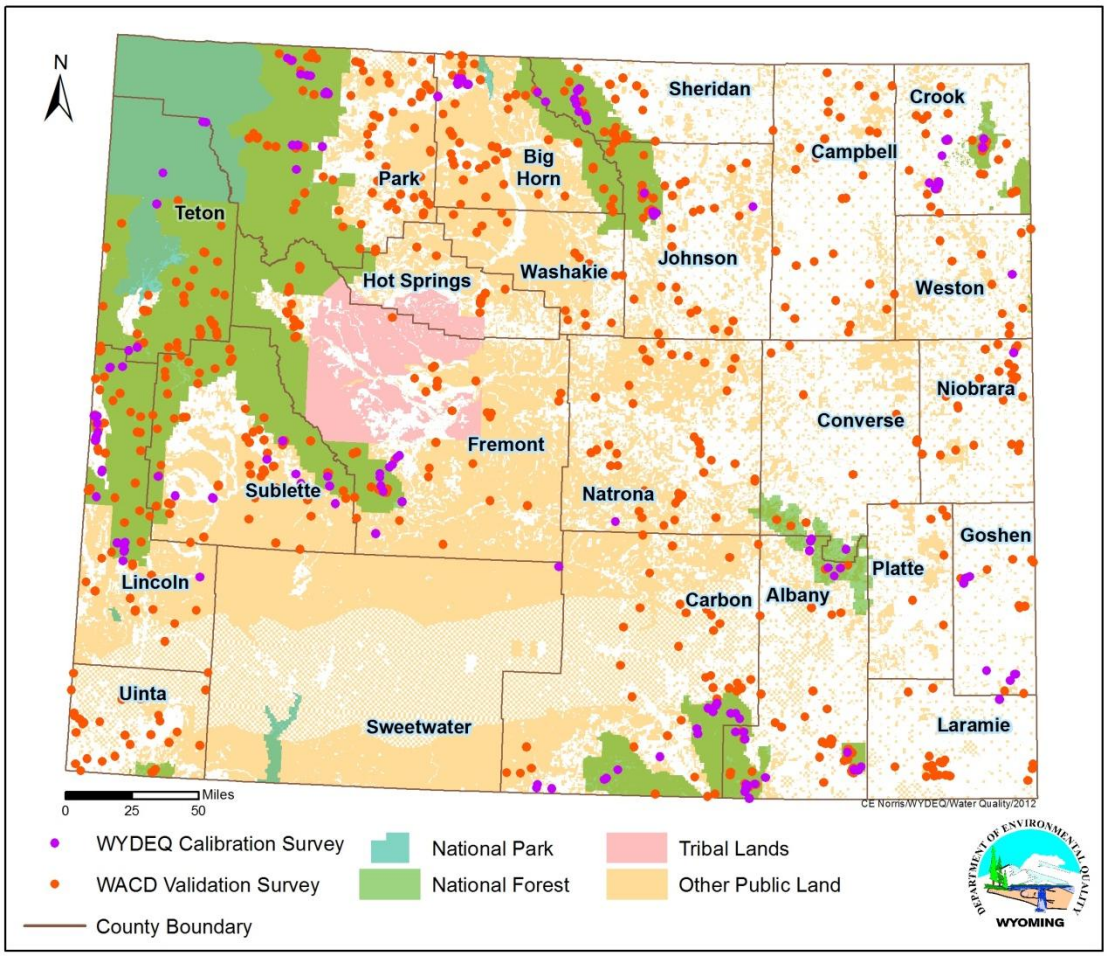

Figure 1. Map showing WDEQ and WACD survey site locations used to calibrate recreational use numbers (RecNum) and validate classification of waters for primary and secondary contact recreation. All points are not visible due to overlapping sites.

surveys (69 basin sites and 82 forest sites) in July 2010 on stream segments expected to be close to the threshold between primary and secondary contact recreation. The greatest agreement between the surveys and the model occurred with RecNum of 38 for forest sites (64.6% agreement, 53 of 82 site surveys agreed with model) and 28 for basin sites (70.9% agreement, 48 of 69 sites surveys agreed with model). RecNum of 38 and 28 for forest and basin sites resulted in a total of 66.9% agreement (101 of 151 sites).

A validation survey, completed in the fall of 2010, was facilitated by the Wyoming Association of Conservation Districts (WACD) and conducted by Wyoming's 34 Conservation Districts (Figure 1). One thousand random stream survey points were generated and distributed to WACD along with a worksheet to be completed during each site visit (Figure C-2). Survey questions were assigned values relative to the weights used in the model, each survey was scored, and compared to the predictions of the model. A total of 720 data points were generated from the survey, 219 forest sites and 501 basin sites. There was 60.1% agreement (133 of 219 sites surveyed) for forested sites, 78.2% agreement (392 of 501 sites surveyed) for basin sites, and an overall agreement of 72.9% (525 of 720 sites surveyed) between the WACD survey and the recreational use model.

Extension of Primary Segments

The model designated 80,485 NHD stream segments, 19,161 miles, for primary contact recreation (Figure 2). Because streams in NHD are divided into segments, the model produced many short, isolated primary contact recreation stream segments that did not correspond to natural breaks or watershed boundaries. To minimize the number of isolated segments and address the difficulty of managing waters at such a fine scale, WDEQ/WQD extended stream segments designated for primary contact recreation by the model. Segments designated as primary by the model were extended upstream to either the twelve digit hydrologic unit code (HUC12) watershed boundary or to the longest NHD reach (Figure 3). Segments designated as primary by the model were extended downstream to either the HUC12 watershed boundary or to the confluence of the longest NHD reach. Extending primary segments changed some segments designated as secondary by the model to primary (Figure 4). While extending stream segments eliminated the occurrence of hundreds of short and isolated primary stream segments, many streams are still designated for both primary and secondary contact recreation.

Final Designations

The recreational use model designated 33,832 miles (12%) of Wyoming's streams for primary contact recreation and 246,967 miles (88%) for secondary contact recreation (Figure 5). The model identified 20,269 of Wyoming's waterbodies, or 538,863 acres (91 %), for primary contact recreation and 79,547 waterbodies, or 52,332 acres (9%), for secondary contact recreation (Figure 6).

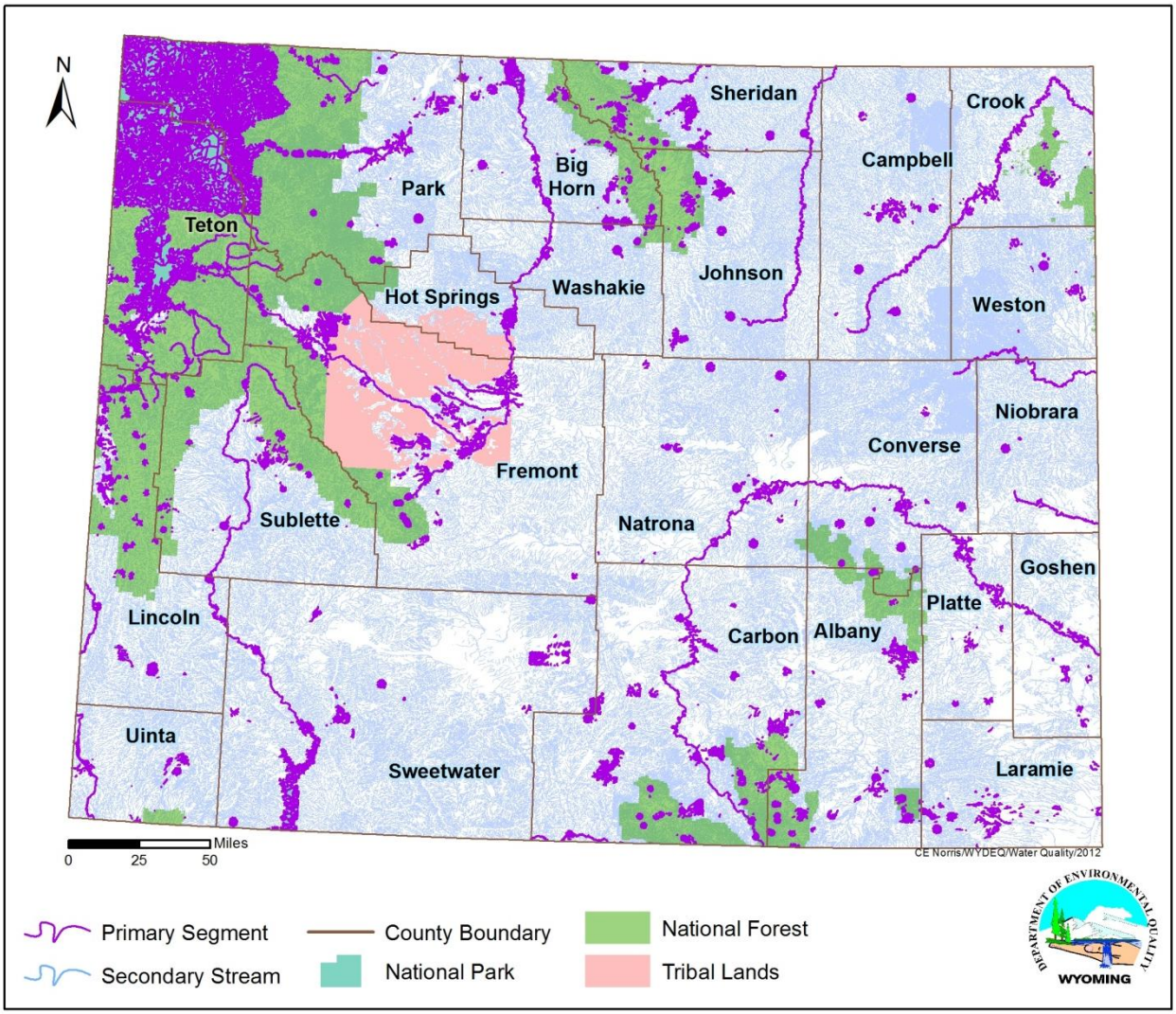

Figure 2. Map of primary recreation stream segments that were determined by recreational use model.

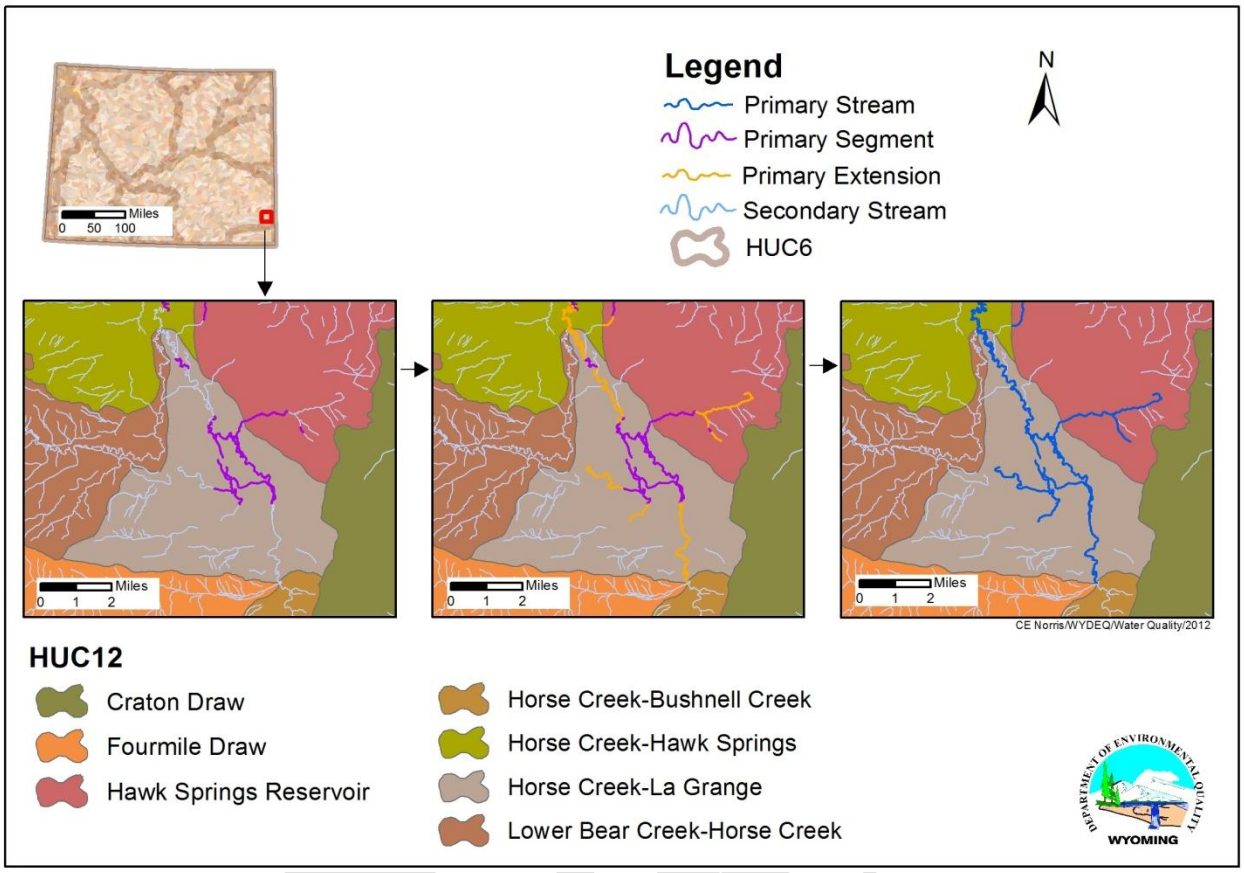

Figure 3. Map series showing an example of the procedure used to extend primary contact recreation segments. Maps show, from left to right, primary contact recreation segments identified by the model, extension of primary segments to HUC12 boundary or longest NHD reach, and final primary and secondary contact recreation designations.

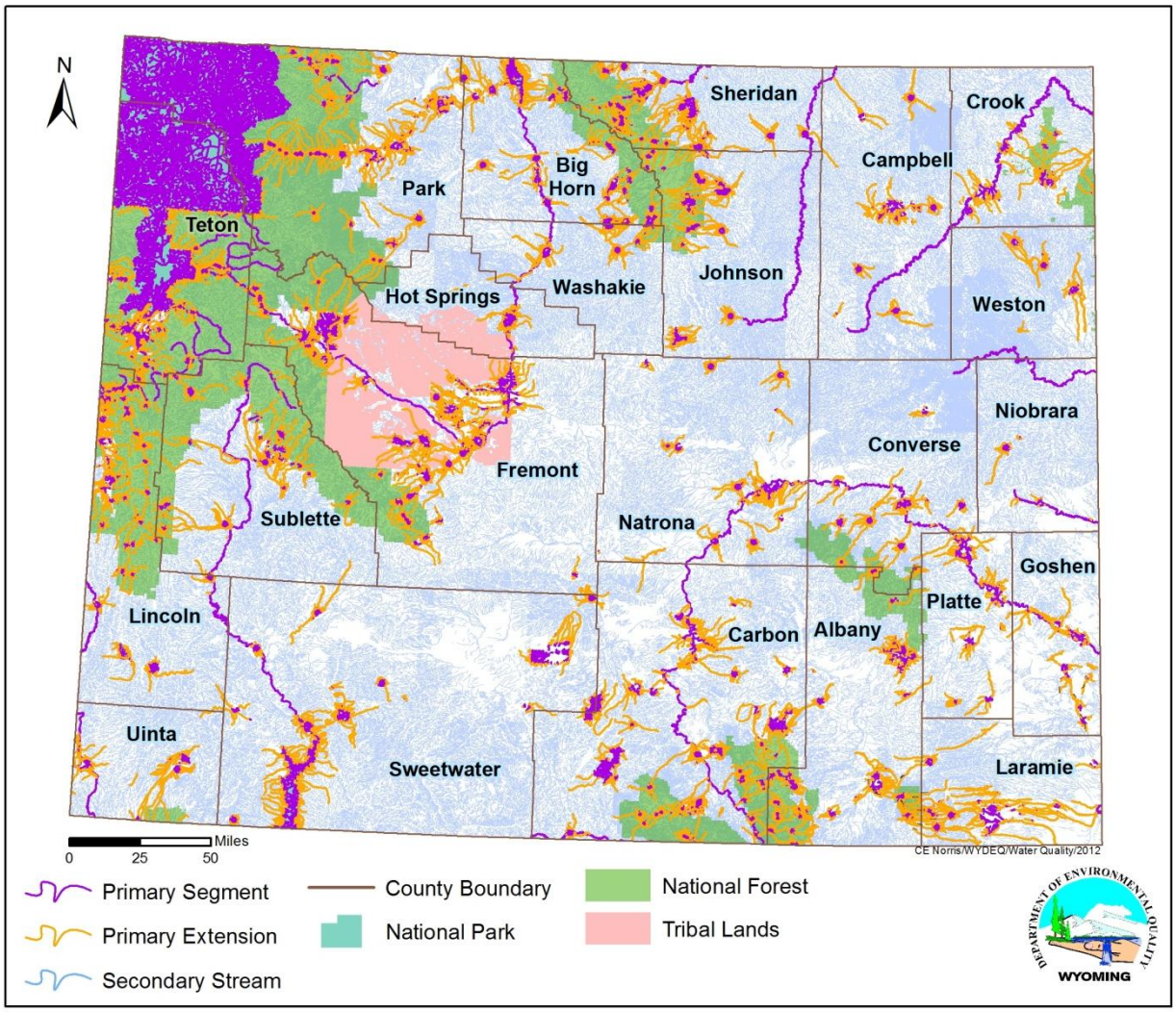

Figure 4. Map of stream segments identified as primary and secondary by the recreational use model and additional stream segments identified as primary through extension.

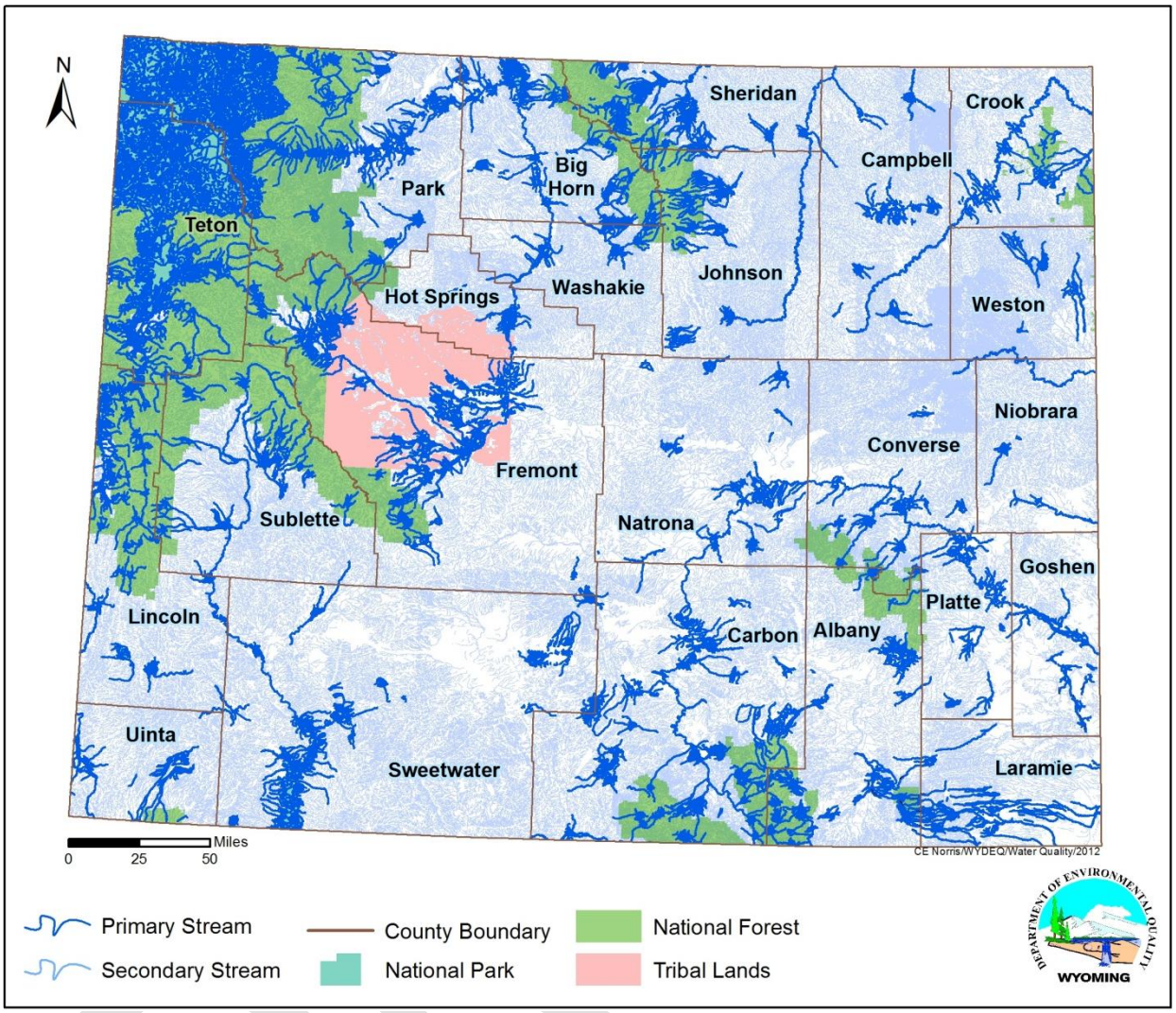

Figure 5. Map of primary and secondary contact recreation streams determined by the recreational use model.

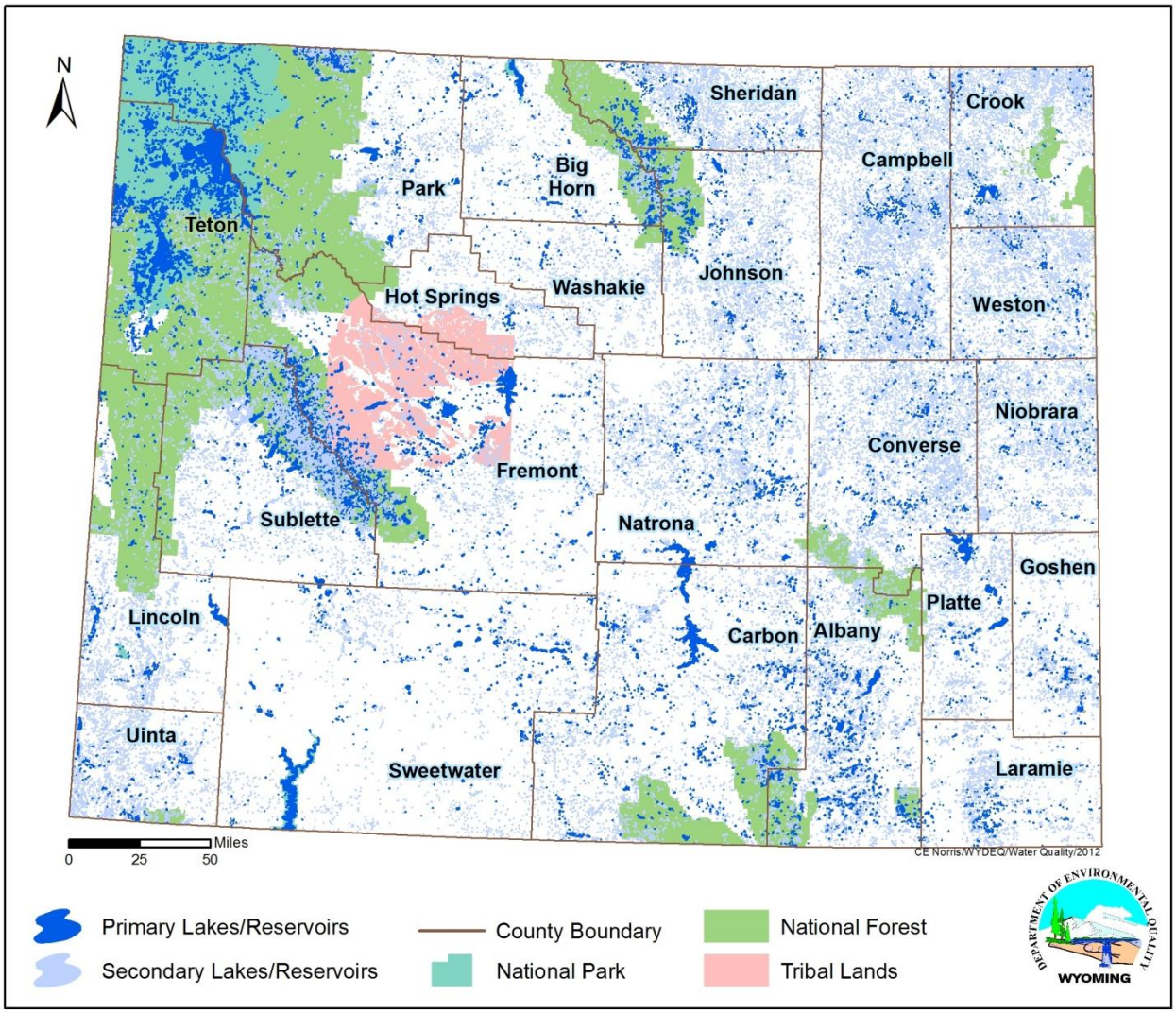

Figure 6. Map of the primary and secondary contact waterbodies determined by the recreational use model.

CONCLUSIONS

The categorical use attainability analysis for recreation effectively identifies which of Wyoming streams and waterbodies should be designated for primary and secondary contact recreation. The GIS layers used in the model represent the most important "factors affecting the attainment of the use" (WDEQ/WQD 2007a; 40 CFR §131.3(f)). These factors included physical and biological information for each waterbody, fulfilling the information requirements for UAAs outlined in state and federal regulations (Section 33(b)(ii) and (v); 40 CFR §131.10(g)(2) and (5)). The model also follows Wyoming's *Use Attainability Analysis Implementation Policy* and "is based solely on the relative potential of exposure to human populations," with considerations of "water availability, access, and recreational opportunity" (WDEQ/WQD 2007b). The model took into consideration a "suite of factors" and represents the existing and potential recreational use of waters of the state more accurately than individual UAAs that may focus solely on the six removal factors outlined in Chapter 1, Section 33(b) and 40 CRF §131.10(g).

This approach is consistent with various EPA guidance documents (EPA 1992; EPA 2004) and EPA's approval of previous recreation UAAs in Wyoming.

The GIS layers used in the model represented many of the same factors outlined in WDEQ's Recreational UAA Worksheet and identified by EPA in the recent decision to approve designation of 11 waters in the North Platte River Basin for secondary contact recreation. The factors included in the worksheet and used in the model include: federal, state, and local parks or recreation areas; lakes, reservoirs, or still bodies of water (excluding those less than four acres in size); municipalities or unincorporated high density housing areas (WDEQ/WQD 2007b). The factors cited by EPA and used in the model include consideration of: flow; remoteness; lack of recreational development that would invite primary contact recreational use (e.g. beaches and boat docks); and "isolation from parks, recreation areas, municipalities, high density housing areas, schools, or other areas frequented by children" (EPA 2011).

Changing the recreational use of Wyoming's waters through a categorical UAA is consistent with Chapter 1 (WDEQ/WQD 2007a) and the *Use Attainability Analysis Implementation Policy* (WDEQ/WQD 2007b). This UAA does not preclude future UAA petitions by any interested entity to change the recreational use designation for any water of the state.

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APPENDIX A. DATA SOURCES AND MAPS

Table A-1. Data layers and sources of data used in the recreational use model. Sources without hyperlinks were obtained directly from the source. The data presented at these sites may not be identical to those used in the model as various entities update their information. For original datasets, contact WDEQ/WQD.

LAYER	Source
Streams and Waterbodies	National Hydrography Dataset (USGS; 1:24,000)
Wild and Scenic Rivers	National Wild and Scenic Rivers
Roads	WYDOT Highways, WYDOT County Roads
	USFS Region 2 Roads (Categories 3, 4, and 5)
	USFS Region 4 Roads (Categories 3, 4, and 5)
Trails	Wyoming Geolibrary (Continental Divide of the United States at 1:2,000,000)
	USFS Region 2 Trails
	USFS Region 4 Trails
Fish	Wyoming Game and Fish Department Stream and Lake Database
Trailheads	USFS Region 2 Trailheads
	USFS Region 4 Trailheads
Campgrounds	Wyoming Geolibrary (Campgrounds from the USGS Names Database for Wyoming at 1:24,000)
	USFS Region 2 Campgrounds
	USFS Region 4 Campgrounds
Schools	U.S. Department of Education
	Wyoming Department of Education
USFS Recreation Sites, Natural Areas, Rest Areas	USFS Region 2 Recreation Sites
	USFS Region 4 Recreation Sites
	Wyoming Geolibrary (Natural Area Tourist Visitation Places for Wyoming at 1:100,000)
	Wyoming Department of Transportation
Municipalities/Populated Areas	Wyoming Geolibrary (Municipal Boundaries for Wyoming at 1:24,000)
	US Census Bureau/ESRI
Land Management	Bureau of Land Management
National Park Service Areas, State Parks, Historic Sites, Wildlife Habitat Management Areas	National Park Service
	Wyoming State Parks (State Parks and Historic Sites)
	WHMA - Wyoming Game and Fish Department
Dispersed Campsites	Bighorn, Black Hills, Bridger-Teton, Caribou-Targhee, Medicine Bow, Shoshone, and Uinta National Forests
	WDEQ Direct Observation (Portions of Shoshone, Bighorn, and Bridger-Teton National Forests)

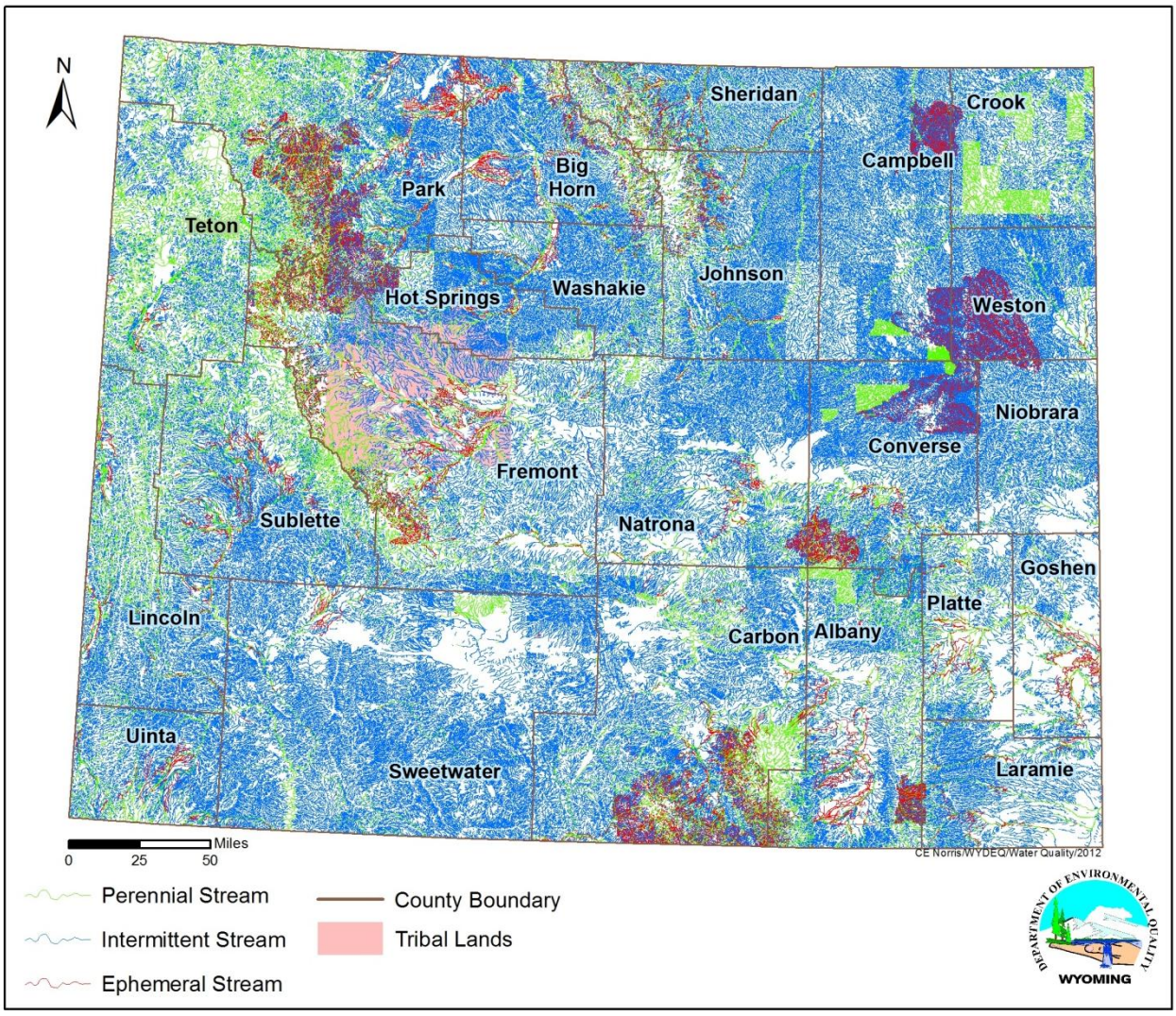

Figure A-1. Map of the National Hydrography Dataset (NHD) hydrologic classification (i.e. perennial, intermittent, and ephemeral) of streams used in the recreational use model.

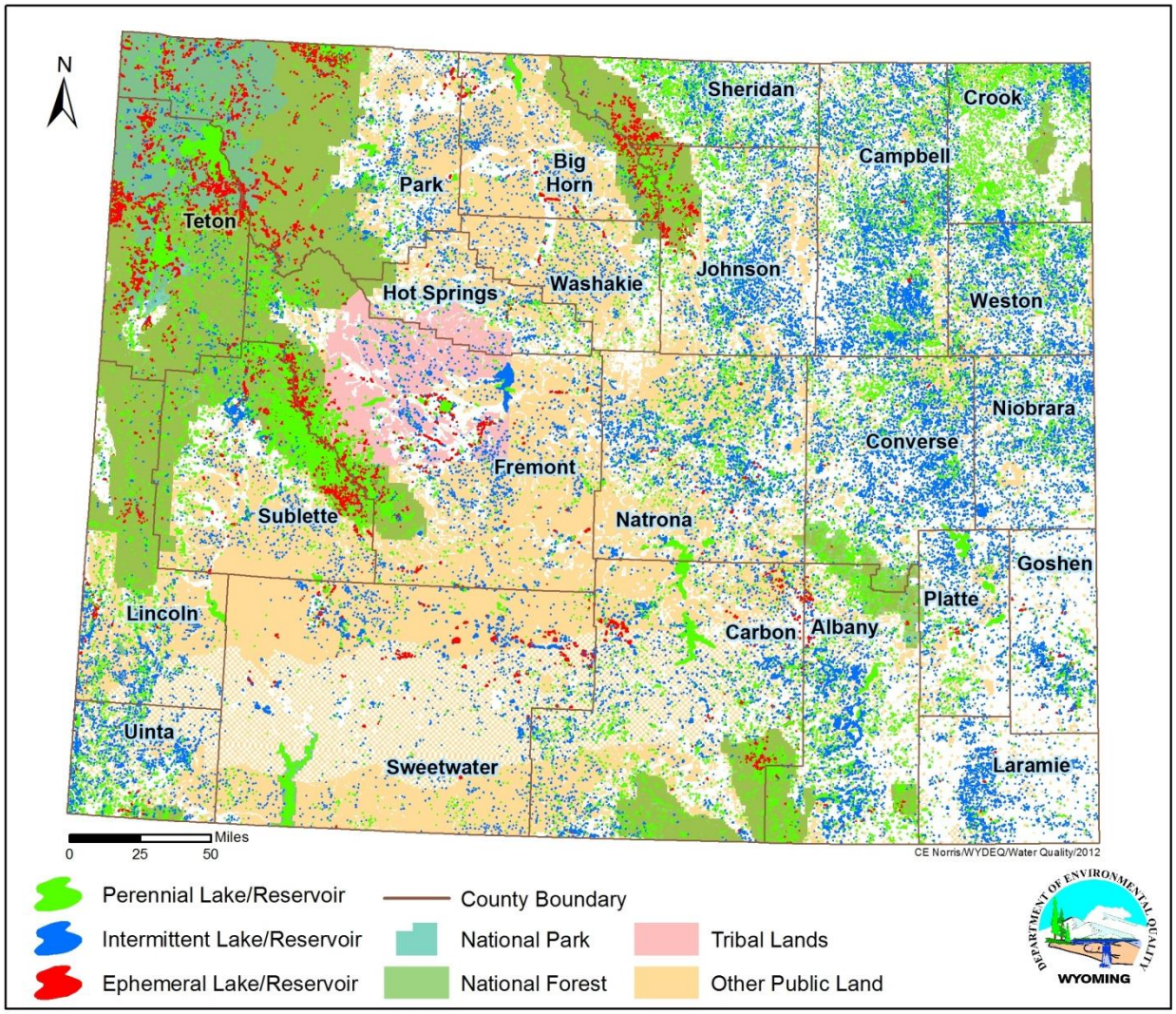

Figure A-2. Map of the National Hydrography Dataset (NHD) hydrologic classification (i.e. perennial, intermittent, and ephemeral) of waterbodies used in the recreational use model.

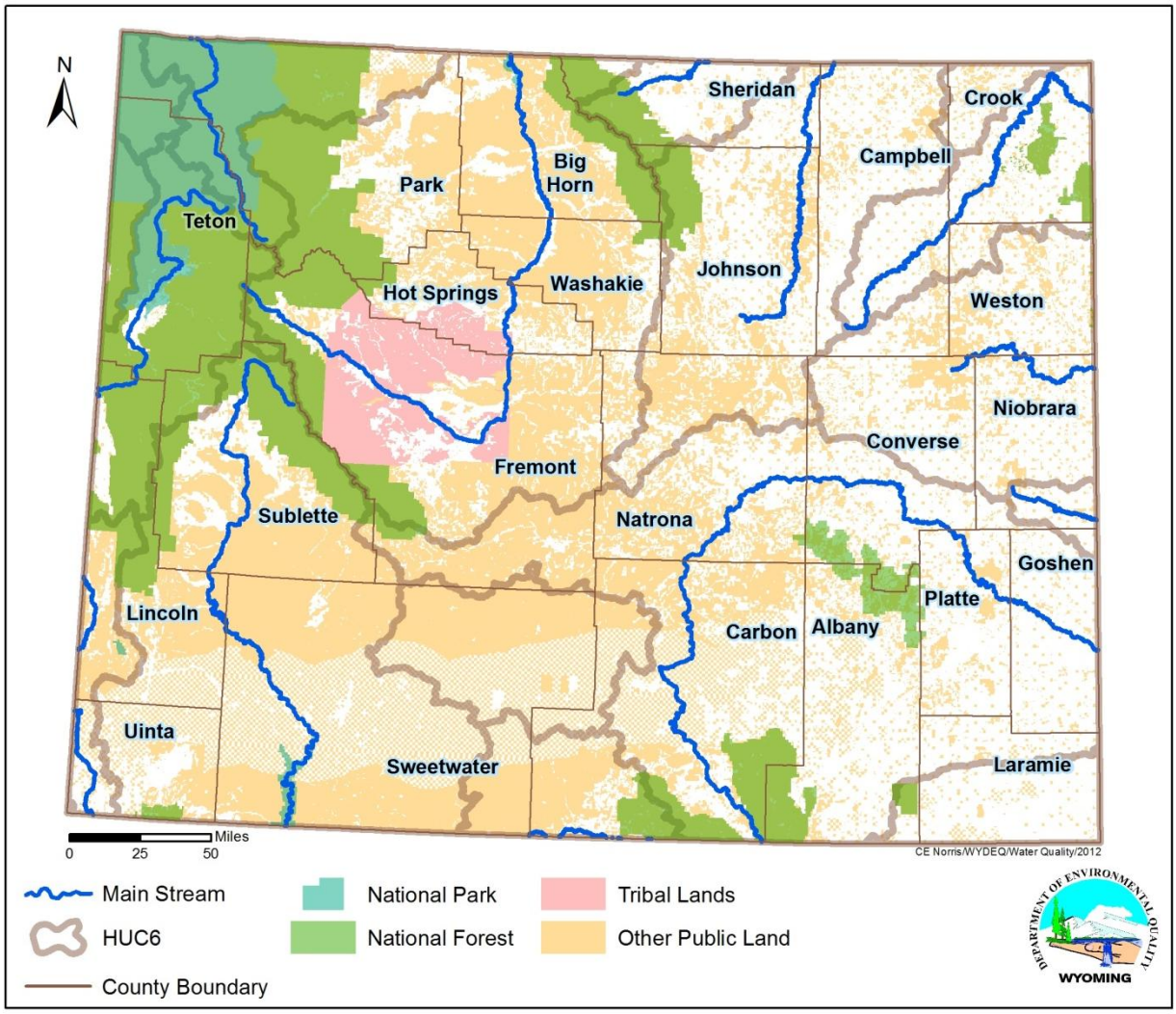

Figure A-3. Map of the largest stream in each of the major river basins or six digit hydrologic unit code (HUC6) used in the recreational use model.

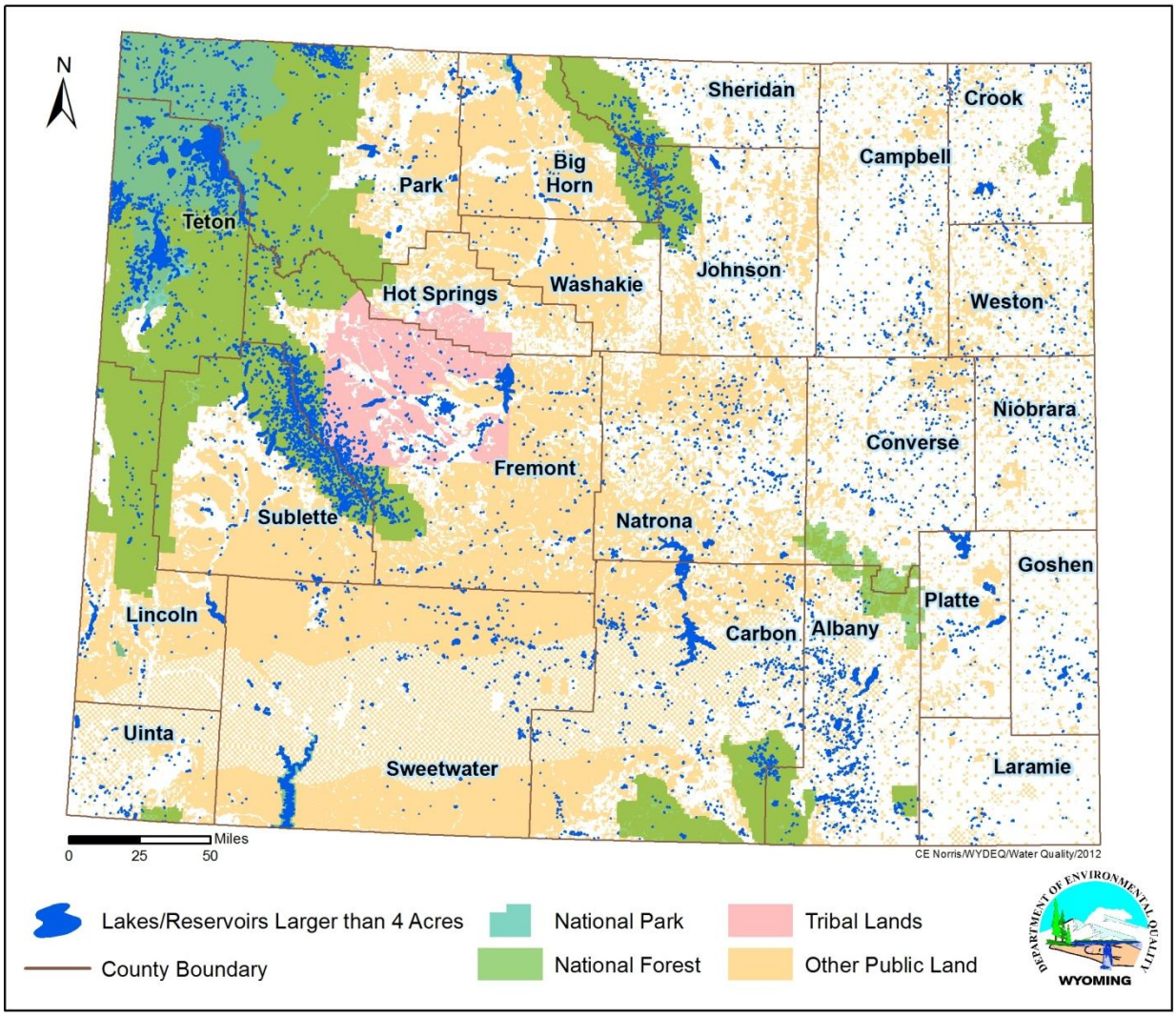

Figure A-4. Map of the National Hydrography Dataset (NHD) waterbodies greater than 4 acres in size used in the recreational use model.

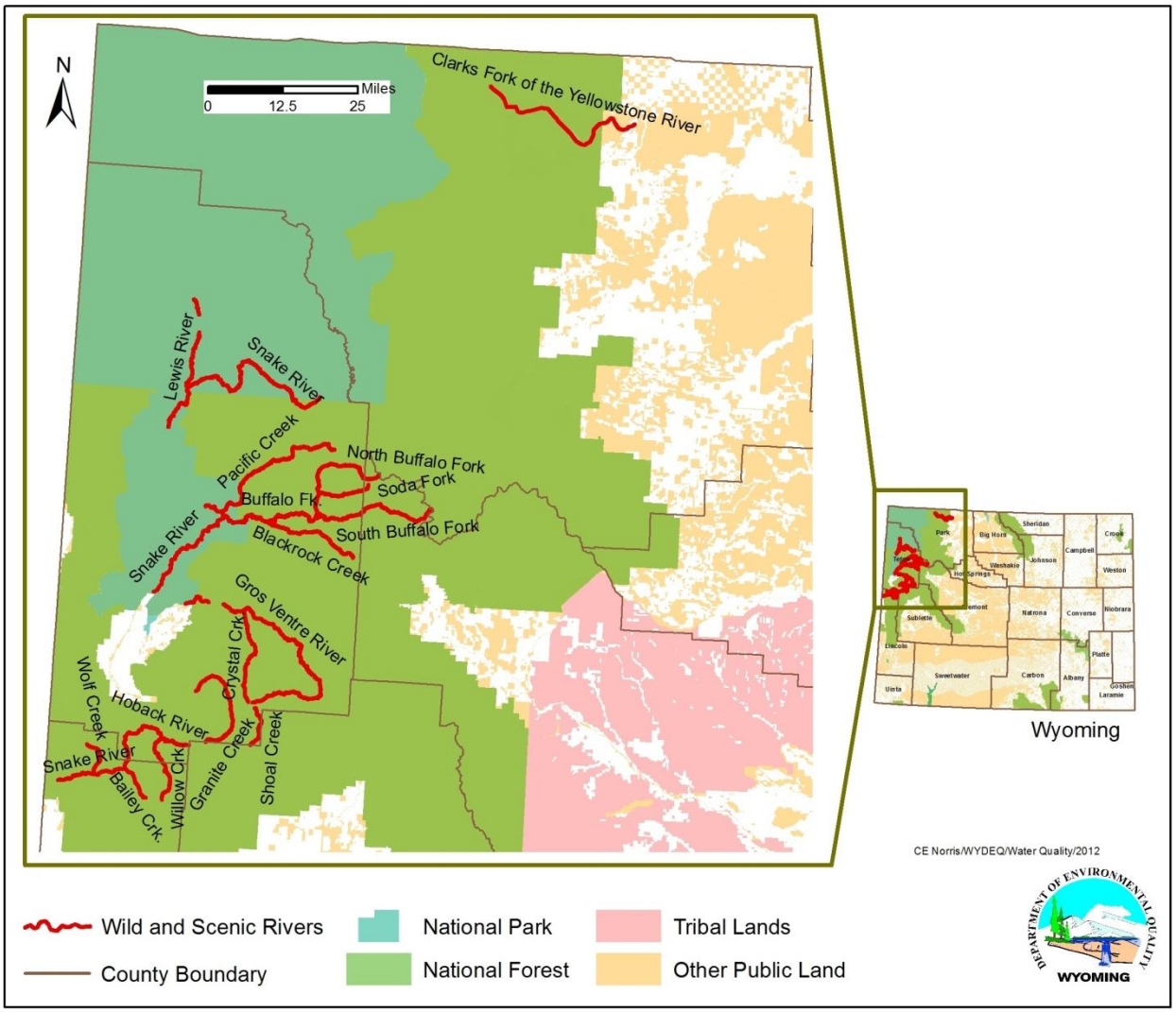

Figure A-5. Map of the Wild and Scenic Rivers dataset used in the recreational use model.

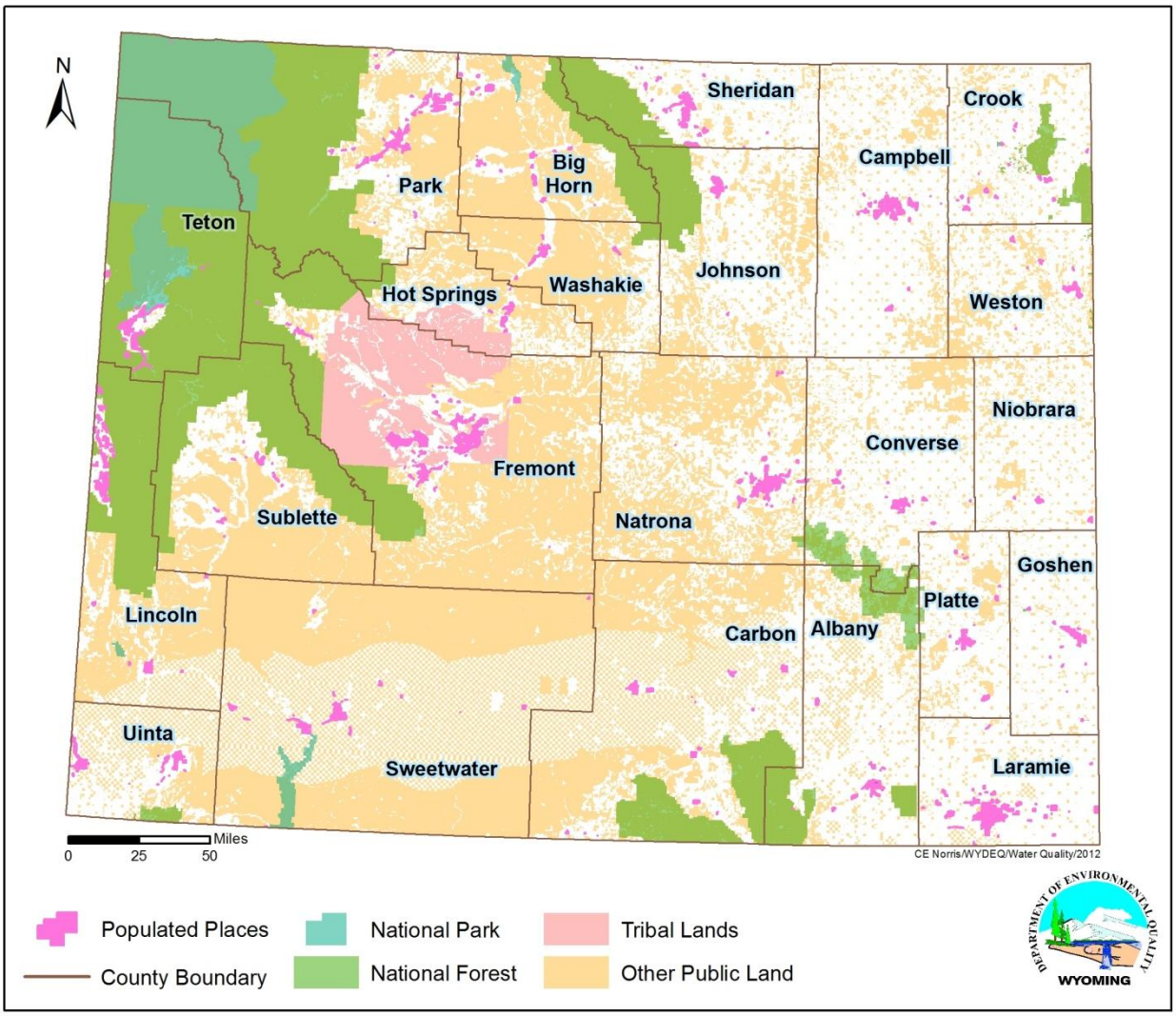

Figure A-6. Map of the populated places data layer used in recreational use model.

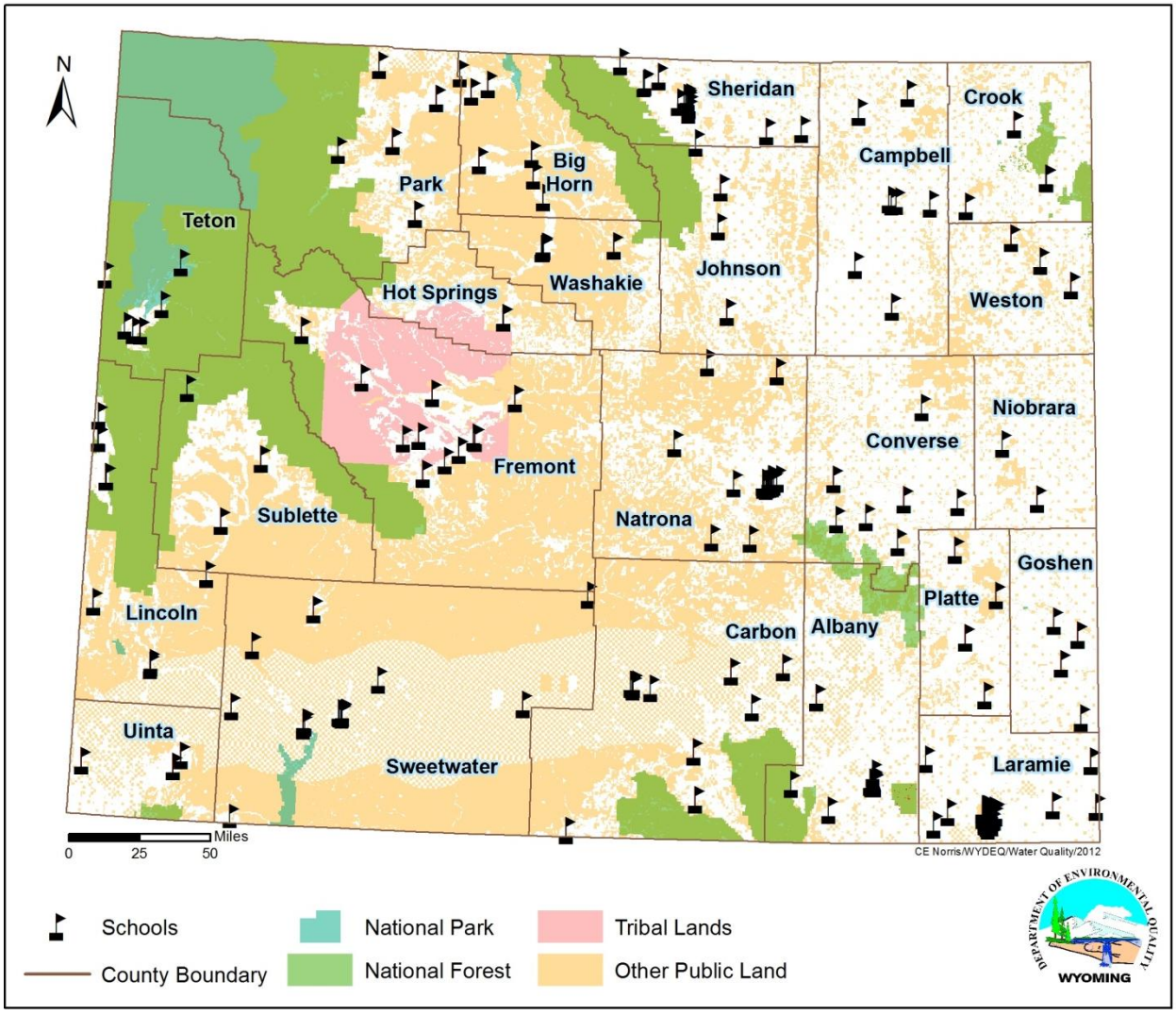

Figure A-7. Map of the school locations used in the recreational use model.

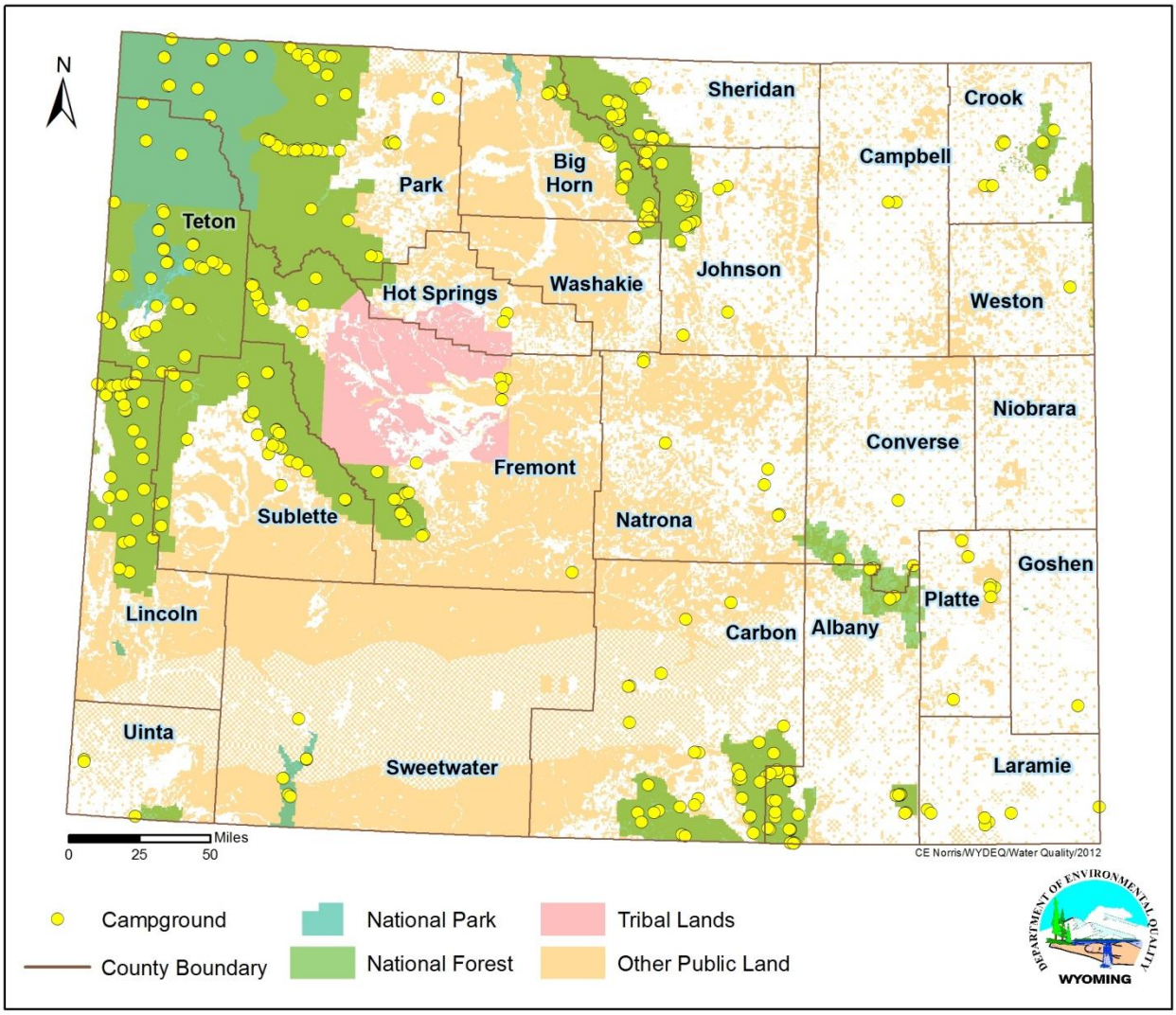

Figure A-8. Map of the developed campground locations used in the recreational use model.

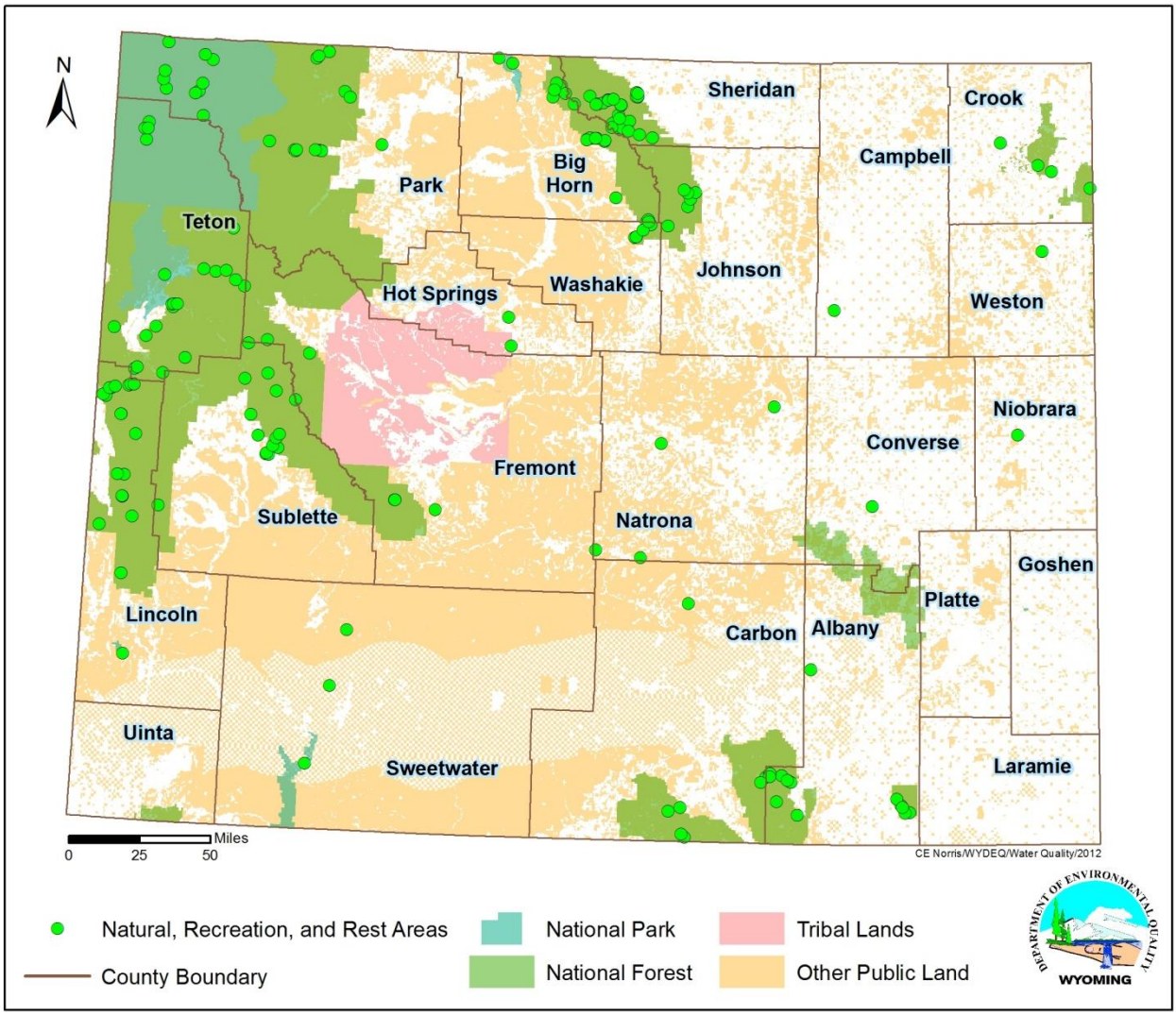

Figure A-9. Map of the natural areas, United States Forest Service (USFS) recreation sites, and Wyoming Department of Transportation (WYDOT) rest areas used in the recreational use model.

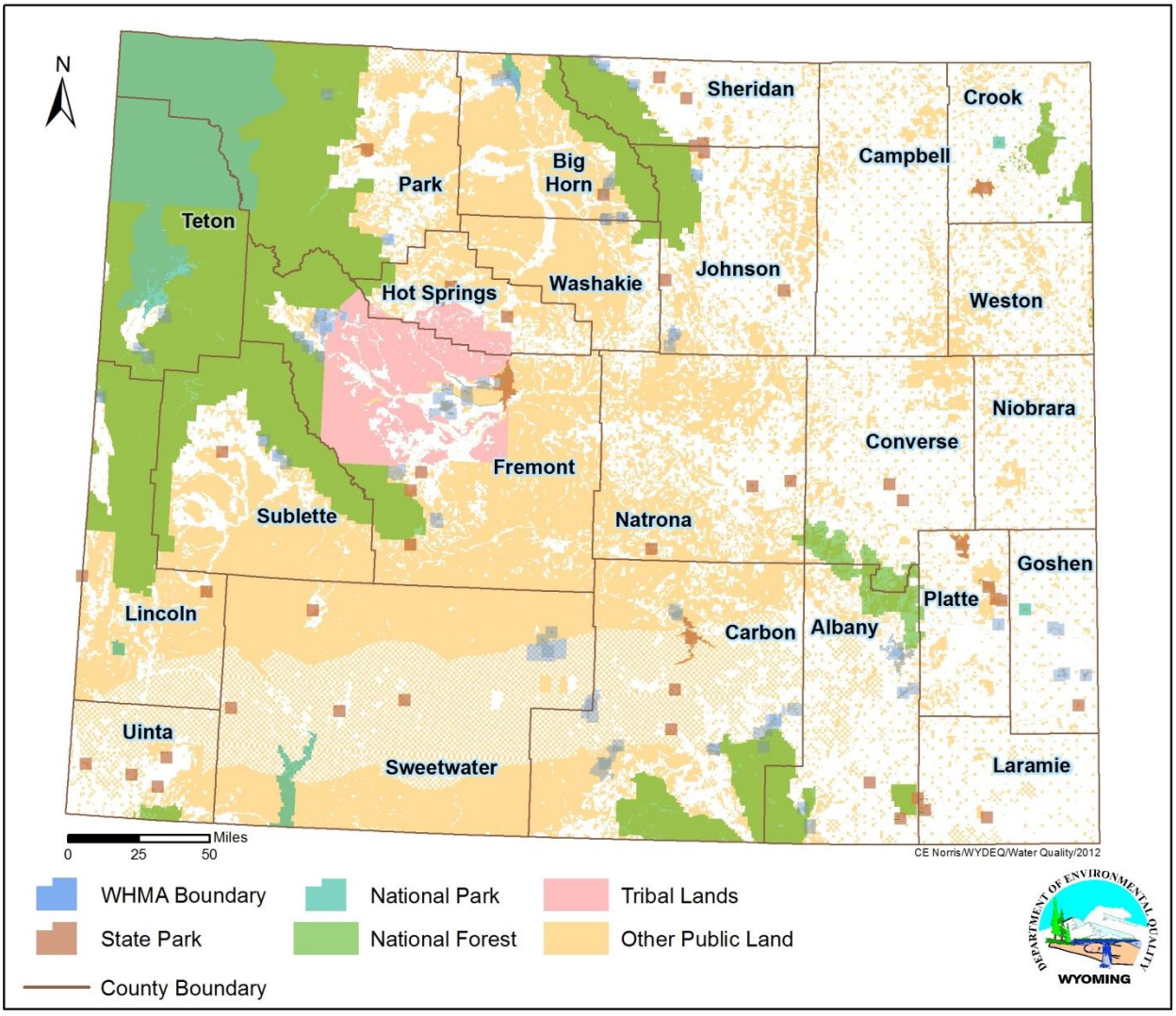

Figure A-10. Map of the National Park Service Recreation Areas, State Parks and Historic Sites, and Wildlife Habitat Management Areas (WHMA) used in the recreational use model.

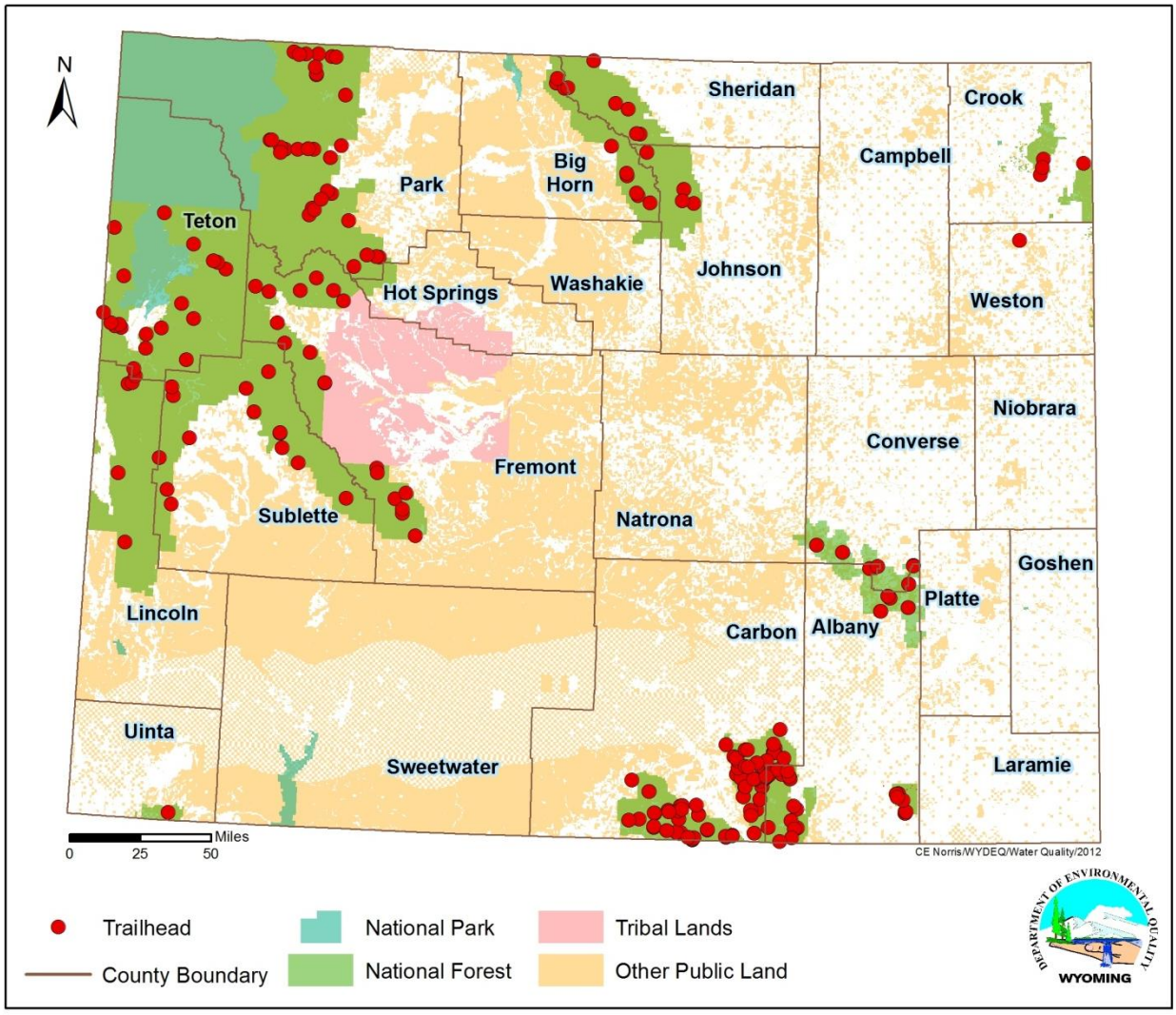

Figure A-11. Map of the trailhead locations used in the recreational use model.

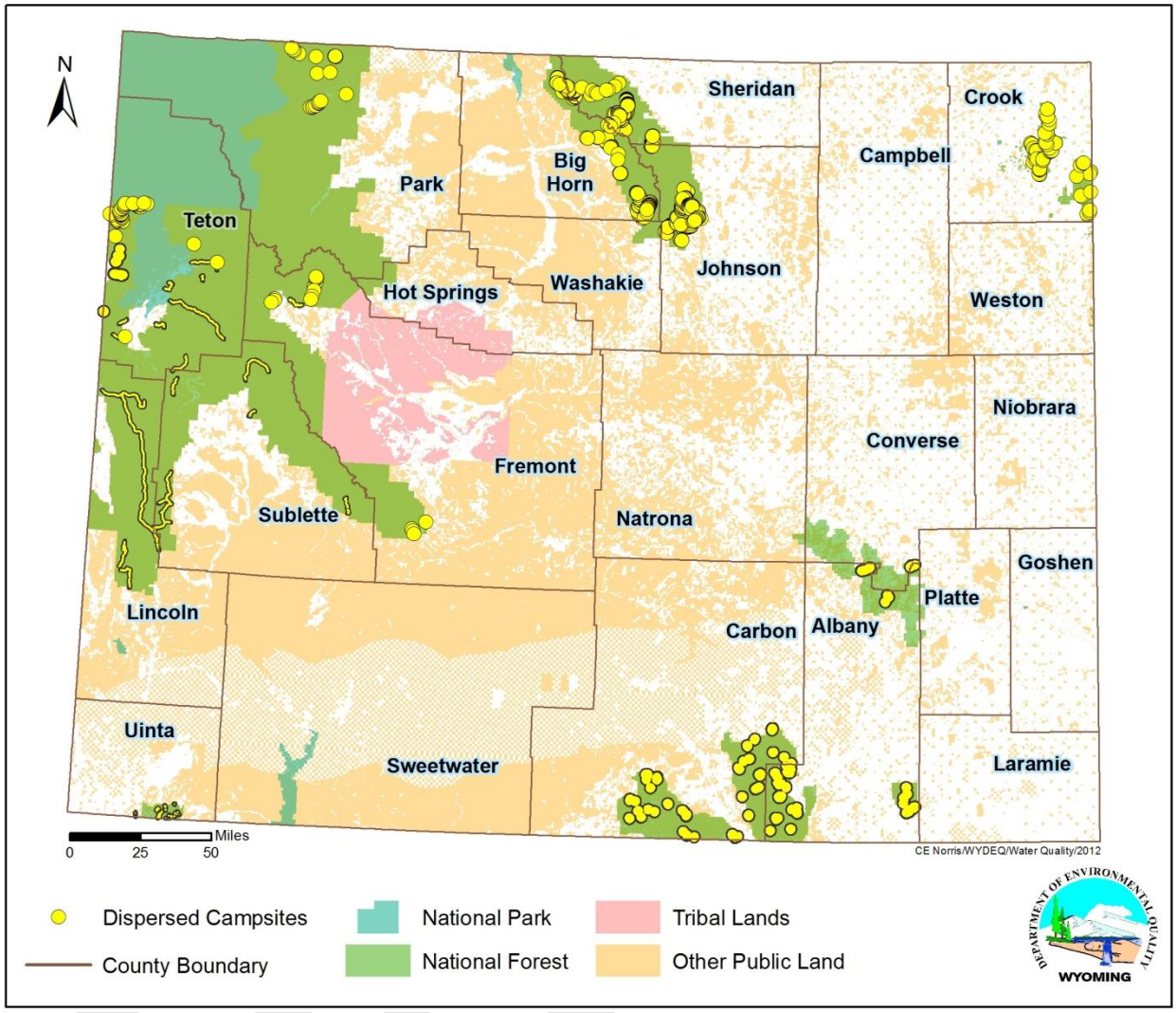

Figure A-12. Map of the dispersed campsite locations (point, line, and polygon features) on U.S. Forest Service (USFS) land used in the recreational use model.

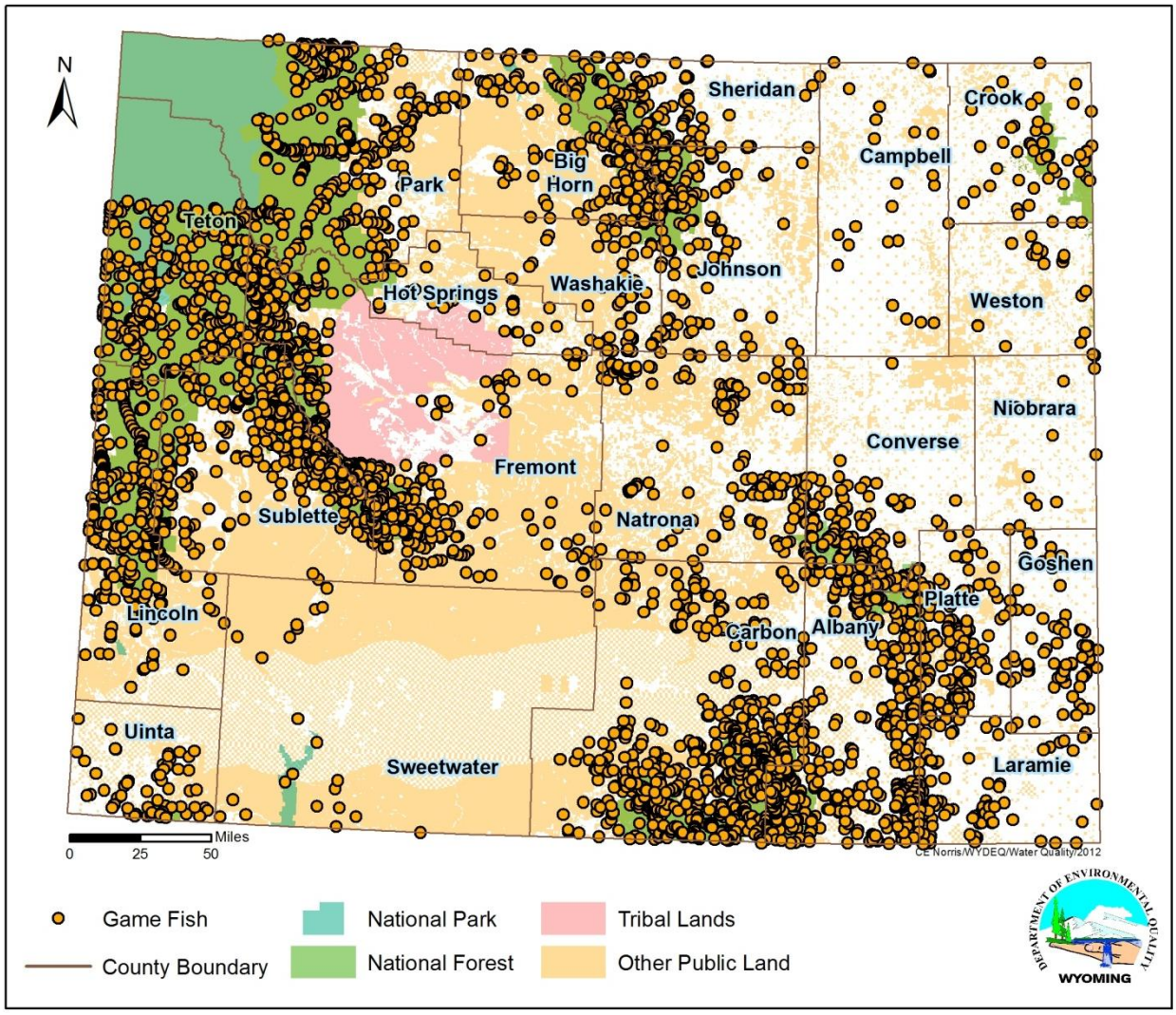

Figure A-13. Map of Wyoming Game and Fish Department (WGFD) Stream and Lake Database sampling sites with game fish used in the recreational use model.

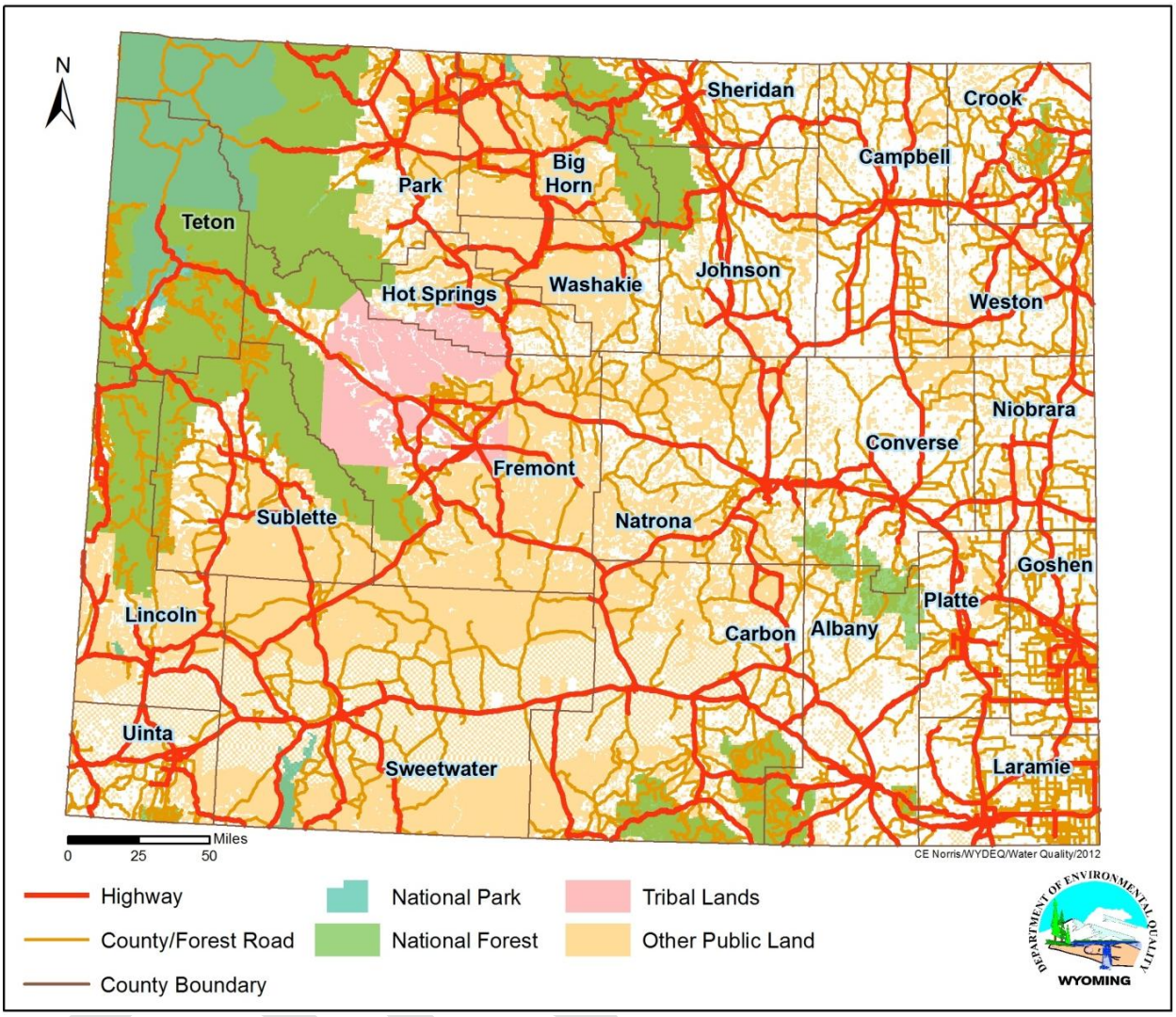

Figure A-14. Map of the roads layer used in the recreational use model.

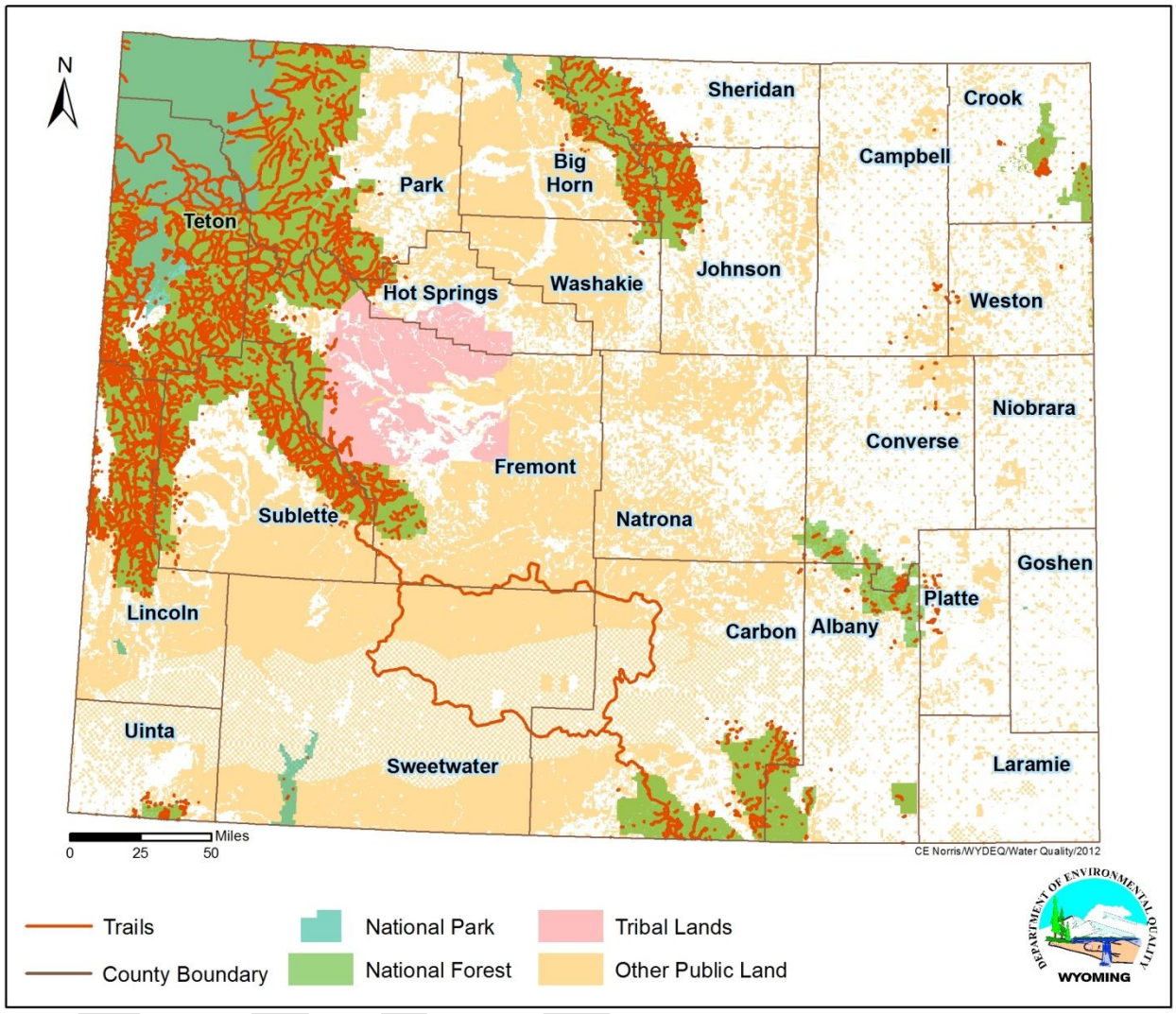

Figure A-15. Map of the trails dataset used in the recreational use model.

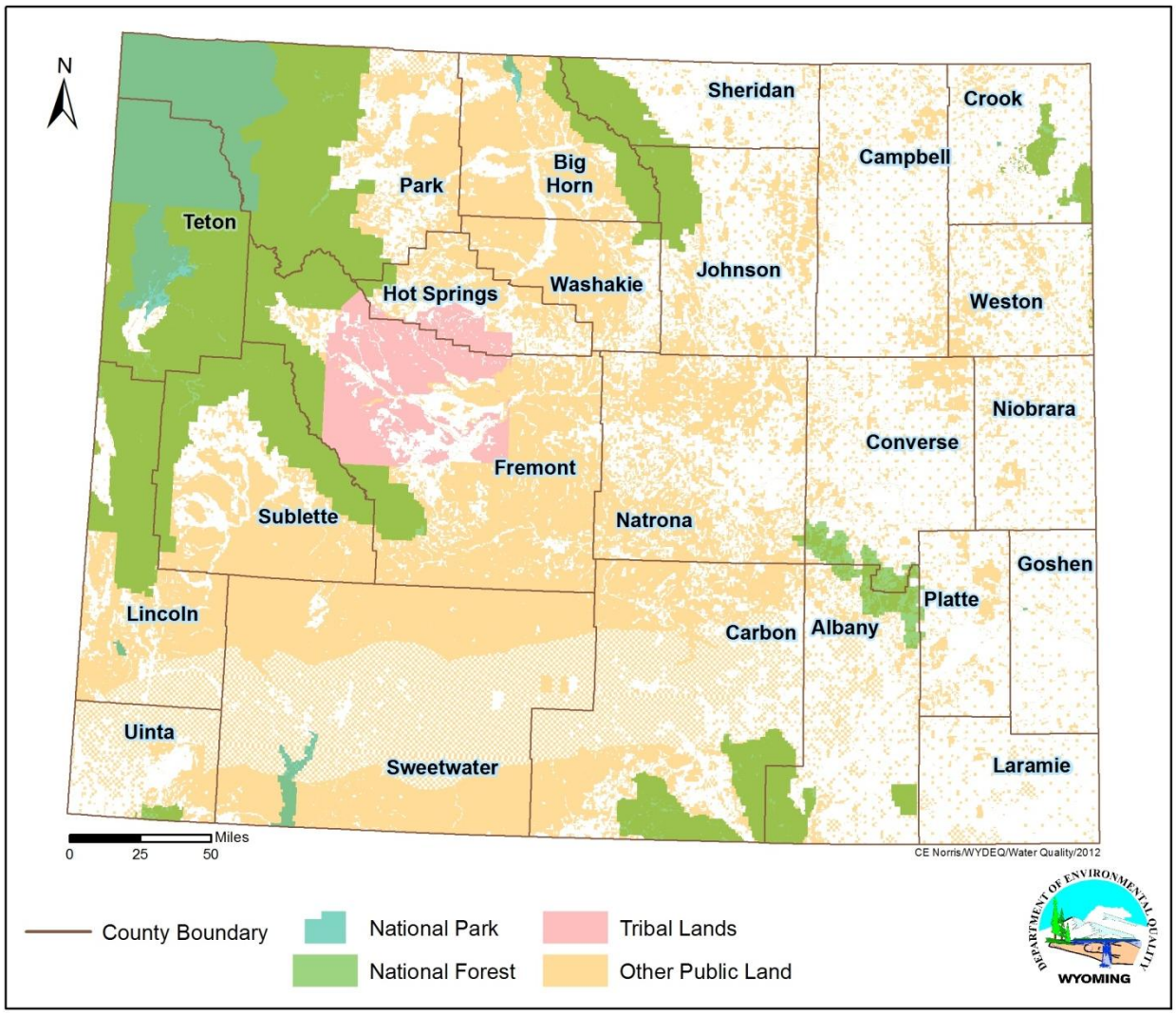

Figure A-16. Map of the land management layer used in the recreational use model.

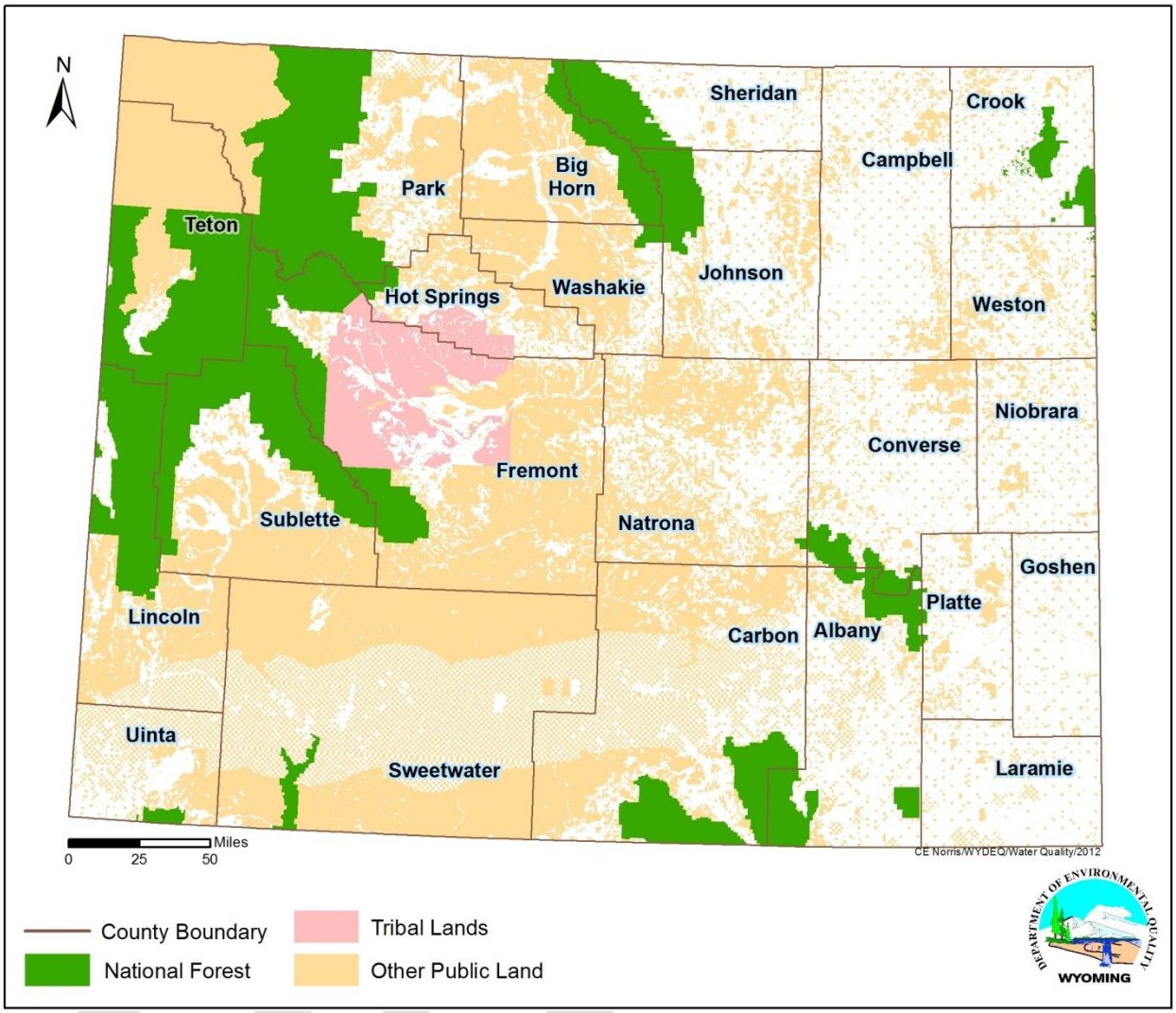

Figure A-17. Map of the United States Forest Service (USFS) areas used to determine recreational use numbers (RecNum) in forest and non-forest (basin) locations.

APPENDIX B. MODEL STEPS

1. Download NHD High Resolution file for WY (ftp://nhdftp.usgs.gov/DataSets/Staged/States/FileGDB/HighResolution/).

2. Create new map, add NHD Flowline and Waterbody layers from NHD High Resolution file. Clip to Wyoming state boundaries.

3. Add StrmClass field to NHD attribute table based on FCode field in the NHD. Assign value '7' to all perennial streams and value '3' to all intermittent streams. Artificial pathways, if they have the same name as a perennial or intermittent stream, are assigned that value.

4. Add MainStream field to NHD attribute table. Assign value'100' to major drainages (defined as 'the main stream of a HUC6'). '100' was used throughout for default primary datasets.

5. Add WSR field to NHD GIS attribute table. Assign value '100' to Wild and Scenic Rivers (http://www.rivers.gov/maps.html).

6. Trailheads (http://www.fs.fed.us/r2/gis/datasets_regionwide.shtml http://www.fs.fed.us/r4/maps/gis/index.shtml). Create buffers at 0.5, 2.5, and 3.5 miles. Clip and erase NHD for each buffer. Add Trailhead field to NHD attribute table. Assign clips weightings of '5' for 0.0-0.5 mile, '3' for 0.5-2.5 miles, and '1' for 2.5-3.5 miles. Merge back into one file.

7. Campgrounds (www.piney-wygisc.uwyo.edu - Campgrounds_USGS.zip; http://www.fs.fed.us/r2/gis/datasets_regionwide.shtml, http://www.fs.fed.us/r4/maps/gis/index.shtml). Create buffers at 0.5, 2.5, and 3.5 miles. Clip and erase NHD for each buffer. Add Campground field to NHD attribute table. Assign clips weightings of '100' for 0.0-0.5 miles, '5' for 0.5-2.5 miles, and '3' for 2.5-3.5 miles. Merge back into one file.

8. Dispersed campsites. Individual forests sent data and missing data was gathered by GPS. Create buffers at 0.5, 2.5, and 3.5 miles. Clip and erase NHD for each buffer. Add DispCamp field to NHD attribute table. Assign clips weightings of '5' for 0.0-0.5 mile, '3' for 0.5-2.5 miles, and '1' for 2.5-3.5 miles. Mask out any record with a value other than zero in Campground field. Merge back into one file.

9. School locations (US Dept of Education: nces.ed.gov/surveys/sdds/ed/index.asp, WY Dept. of Education: fusion.edu.wyoming.gov/MySites/Director). Create buffers at 1.5, 3.5, and 4.5 miles. Clip and erase NHD for each buffer. Add School field to NHD attribute table. Assign clips weightings of '100' for 0.0-1.5 miles, '5' for 1.5-3.5 miles, and '3' for 3.5-4.5 miles. Merge back into one file.

10. Trails (www.piney-wygisc.uwyo.edu – continentaldivide.zip; http://www.fs.fed.us/r4/maps/gis/ index.shtml & http://www.fs.fed.us/r2/gis/datasets_regionwide.shtml). Some of the forests have separate files for roads and trails, some are combined. For the combined files, split out the trails by the CFF field. Create buffer at 0.25 miles. Clip and erase NHD for the buffer. Add Trails field to NHD attribute table. Assign clip weighting of '5'. Merge back into one file.

11. Roads (WDEQ@SDE WYDOT County Roads; WYDOT Highways; www.fs.fed.us). Some of the forests have separate files for roads and trails, some are combined. For the combined files, split out the roads by the CFF field. Create buffer at 0.25 miles. Clip and erase NHD for the buffer. Add Roads field to NHD attribute table. Assign clip weighting of '5'. Merge back into one file.

12. Towns (http://www.esri.com/data/download/census2000_tigerline/index.html, WDEQ@SDE WY_Towns). Create buffers at 2.0 and 3.0 miles. Clip and erase NHD for boundary and each buffer. Add TownCB field to NHD GIS attribute table. Assign clips weightings of '100' for boundary, '5' for boundary-2 miles, and '3' for 2-3 miles. Merge back into one file.

13. Land ownership (WDEQ@SDE WY_NamedLandowner). Split Landowner file into 2 files: Public Land and Private Land ('Open Water' was divided to match the surrounding land). Clip and erase NHD for Public Land. Add PublicLnd field to NHD GIS attribute table. Assign Public Land clip weighting of '5'. Merge back into one file.

14. Fish - 2009 fish status (database supplied by Wyoming Game and Fish). From the FishPresent table, create GIS layer. Add GameFish field to NHD attribute table. Select game fish from species code field in FishPresent layer, join by WaterID via crosswalk to NHD, and assign weighting of '7' to GameFish field.

15. National and State Parks and Wildlife Habitat Management Areas (nrdata.nps.gov for National Parks; state park files supplied by Wyoming State Parks, Historic Sites, and Trails; WHMA files supplied by Wyoming Game and Fish). Create buffers at 2.0 and 3.0 miles. Clip and erase NHD for boundary and each buffer. Add ParksWHMA field to NHD attribute table. Assign clips weightings of '100' for boundary, '5' for boundary-2 miles, and '3' for 2-3 miles. Merge back into one file.

16. Natural Areas, Recreation Sites, and Rest Areas (www.piney-wygisc.uwyo.edu - natural_areas.zip, http://www.fs.fed.us, WYDOT). Create buffers at 0.5, 2.5, and 3.5 miles. Clip and erase NHD for each buffer. Add NatRecRest field to NHD attribute table. Assign clips weightings of '100' for 0.0-0.5 miles, '5' for 0.5- 2.5 miles, and '3' for 2.5-3.5 miles. Merge back into one file.

17. Add up weights from all fields to determine RecNum.

18. Clip streams by forest area. RecNum forest ≥ 38 and RecNum basin ≥ 28 are primary.
19. Complete same steps for lakes using layers applicable to lakes.

APPENDIX C. WDEQ and WACD SITE SURVEY WORKSHEETS

Figure C-1. WDEQ Recreation Site Survey Worksheet

Segment ID _____

Wyoming Department of Environmental Quality, Water Quality Division

Recreational Use UAA Survey Worksheet

Department worksheet for calibrating model.

Date _____ Observer(s) _____

Time _____ River Basin (6-digit HUC number) _____

Waterbody Name _____ Watershed (8-digit HUC number) _____

Survey Location Description, including land ownership _____

_____

County _____ Elevation (ft) _____

Latitude*(WDEQ) _____ Longitude*(WDEQ) _____

Latitude*(CD) _____ Longitude*(CD) _____

GPS Datum and Coordinate System _____

Photo identification

1 _____ 2 _____

3 _____ 4 _____

Photo notes: _____

_____

Answer each of the following questions with either a *yes* or *no*:

1. _____ Is the survey location within a designated federal, state, or local park or recreational area? (*Federal, state or local parks should not be construed to mean all public lands, but rather, specifically developed and/or designated recreational use areas such as campgrounds, picnic grounds, trailheads, greenways, etc.*)
2. _____ Is the survey location part of a lake, reservoir or other still body of water. *(Exclude small (less than 1 square acre) stock watering ponds and waste effluent treatment ponds).*
3. _____ Is the survey location contained within a municipality or unincorporated high density housing area.
4. _____ Is the survey location on a water that is a larger perennial stream or game fishery known to be used by sportsmen or other recreationists?

1

Figure C-1 (cont).

Segment ID _____

5. _____ Is the survey location either currently known to be *or* do you believe that it has a reasonable potential to be used for recreational activities such as fishing, swimming, floating, rafting, canoeing or kayaking?

6. _____ Are there any schools within view of the survey location?

7. _____ Is there currently water within the surveyed stream, lake, reservoir or wetland?

8. _____ Does the survey location occur on public land?

9. _____ Are there any major recreational trails, trailheads or developed campgrounds within view of the survey location?

10. _____ Modeled as Primary Stream?

11. _____ Assessed on a Primary Segment (as modeled)?

Primary characteristics observed: _____

_____

_____

_____

Secondary characteristics observed: _____

_____

_____

_____

Appropriate stream classification assigned by model? Yes _____ No _____

Notes: _____

_____

_____

_____

_____

2

Figure C-2. WACD Recreation Site Survey Worksheet.

Wyoming Department of Environmental Quality, Water Quality Division

Recreational Use UAA Survey Worksheet

Each of Wyoming's 34 Conservation Districts has been provided with a randomly generated list of *survey locations* occurring on waters within their district. Each *survey location* refers to a single set of randomly generated latitude and longitude coordinates provided by WDEQ. The information gathered during this statewide survey will ultimately be compared to the predictions of a Geographic Information System (GIS) based Recreational Use Model that is currently being developed by WDEQ. Please fill out a separate worksheet completely for each survey location.

Date _____ Observer(s) _____

Conservation District _____ River Basin (6-digit HUC number) _____

Waterbody Name _____ Watershed (8-digit HUC number) _____

Survey Location Description, including land ownership _____

_____

County _____ Elevation (ft) _____

Latitude*(WDEQ) _____ Longitude*(WDEQ) _____

Latitude*(CD) _____ Longitude*(CD) _____

GPS Datum and Coordinate System _____
(Datum: NAD 83 [alternative WGS 84], Coordinate: UTM [12 - west part of state, 13 – east part of the state] are the preferred GPS settings)

*Please record both the coordinates supplied by WDEQ (on left above) and the coordinates observed using GPS in the field by CD personnel to verify that the correct survey location was visited.

Photographs (Please take one digital photograph looking upstream and one looking downstream from each survey location. Photo names should include the water's name and a unique number):

_____

Answer each of the following questions with either a *yes* or *no*:

1. _____ Is the survey location within a designated federal, state, or local park or recreational area? (*Federal, state or local parks should not be construed to mean all public lands, but rather, specifically developed and/or designated recreational use areas such as campgrounds, picnic grounds, trailheads, greenways, etc.*)

2. _____ Is the survey location part of a lake, reservoir or other still body of water. *(Exclude small (less than 1 square acre) stock watering ponds and waste effluent treatment ponds).*

3. _____ Is the survey location contained within a municipality or unincorporated high density housing area.

Figure C-2 (cont).

4. _____ Is the survey location on a water that is a larger perennial stream or game fishery known to be used by sportsmen or other recreationists?

5. _____ Is the survey location either currently known to be *or* do you believe that it has a reasonable potential to be used for recreational activities such as fishing, swimming, floating, rafting, canoeing or kayaking?

6. _____ Are there any schools within view of the survey location?

7. _____ Is there currently water within the surveyed stream, lake, reservoir or wetland?

8. _____ Does the survey location occur on public land?

9. _____ Are there any major recreational trails, trailheads or developed campgrounds within view of the survey location?